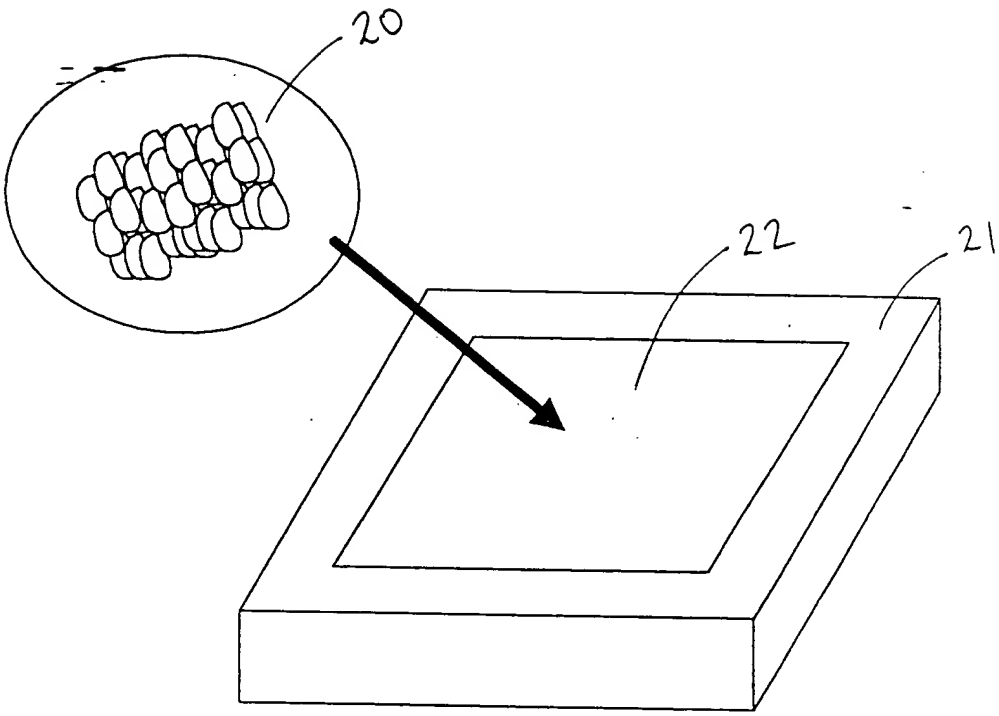


FIG. 1

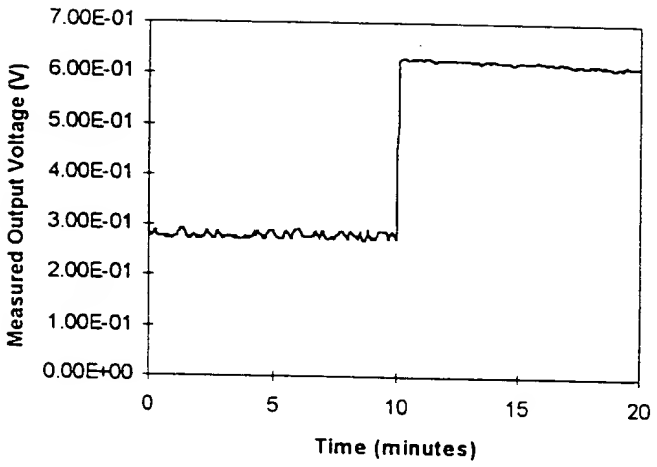

7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Measured Output Voltage (V)
0
5
10
15
20
Time (minutes)

FIG. 2

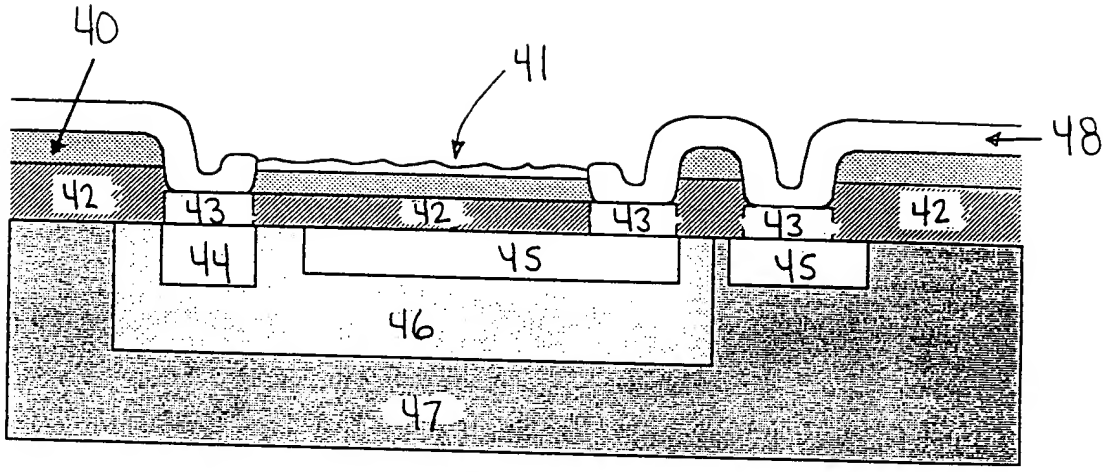


FIG. 3A

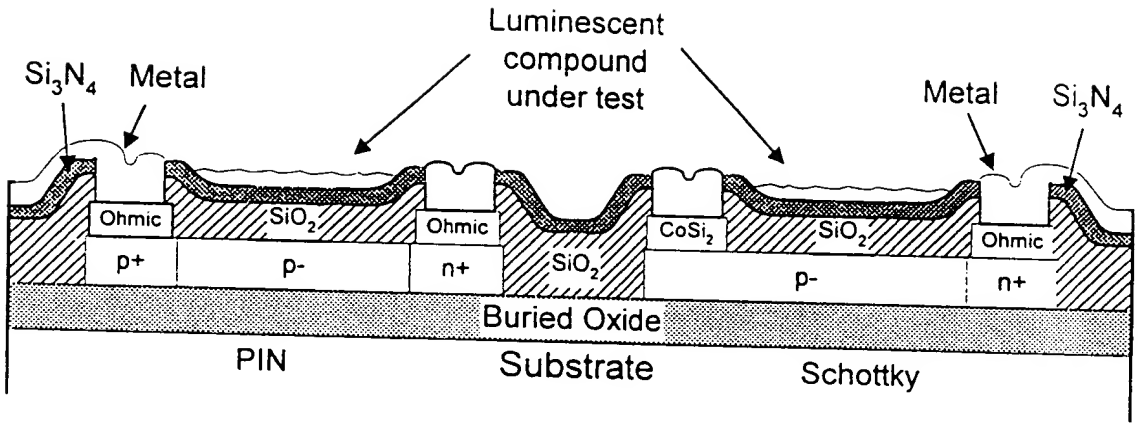


FIG. 3B

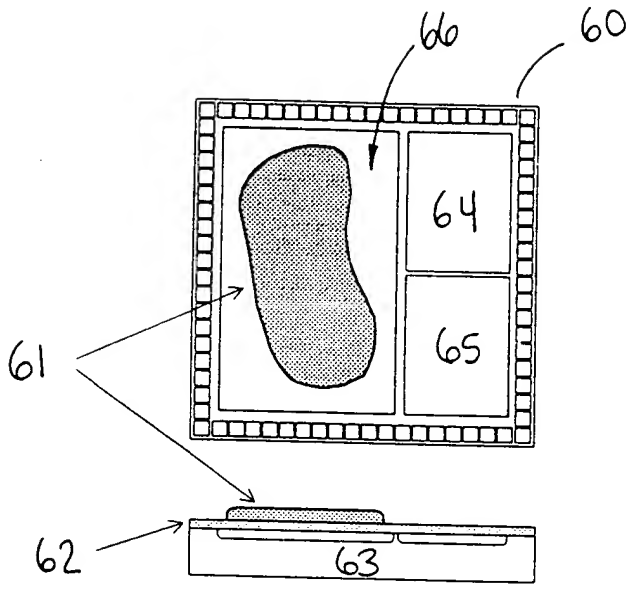


FIG. 4

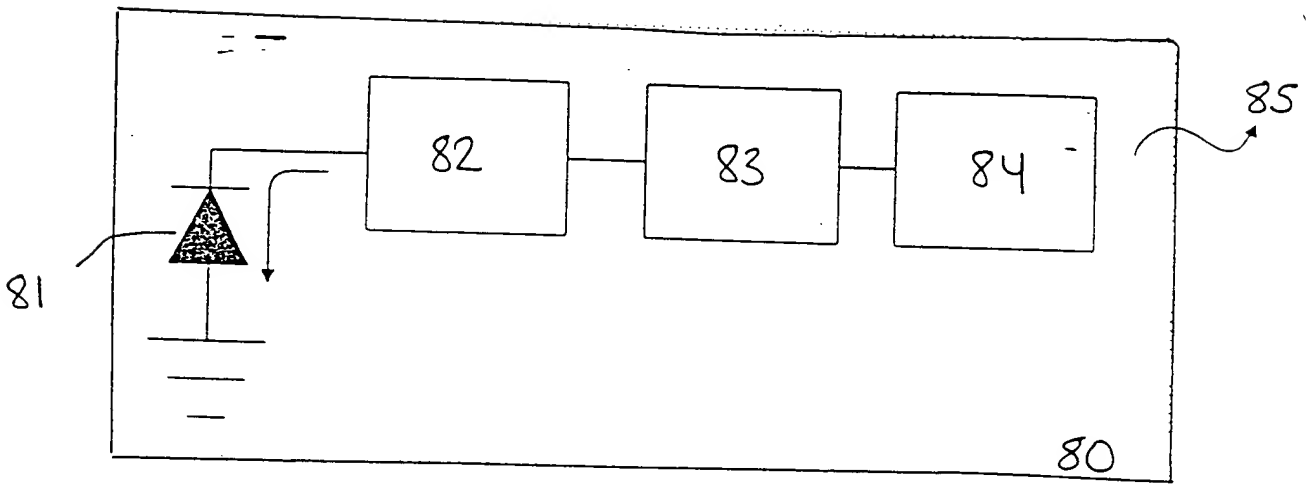


FIG. 5

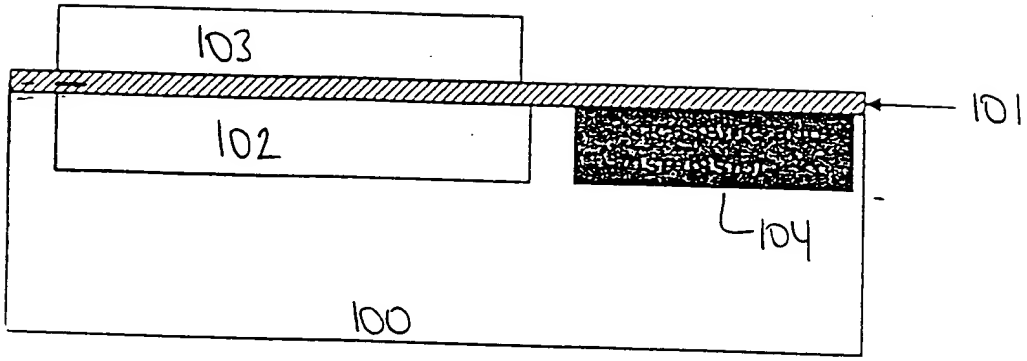


FIG. 6

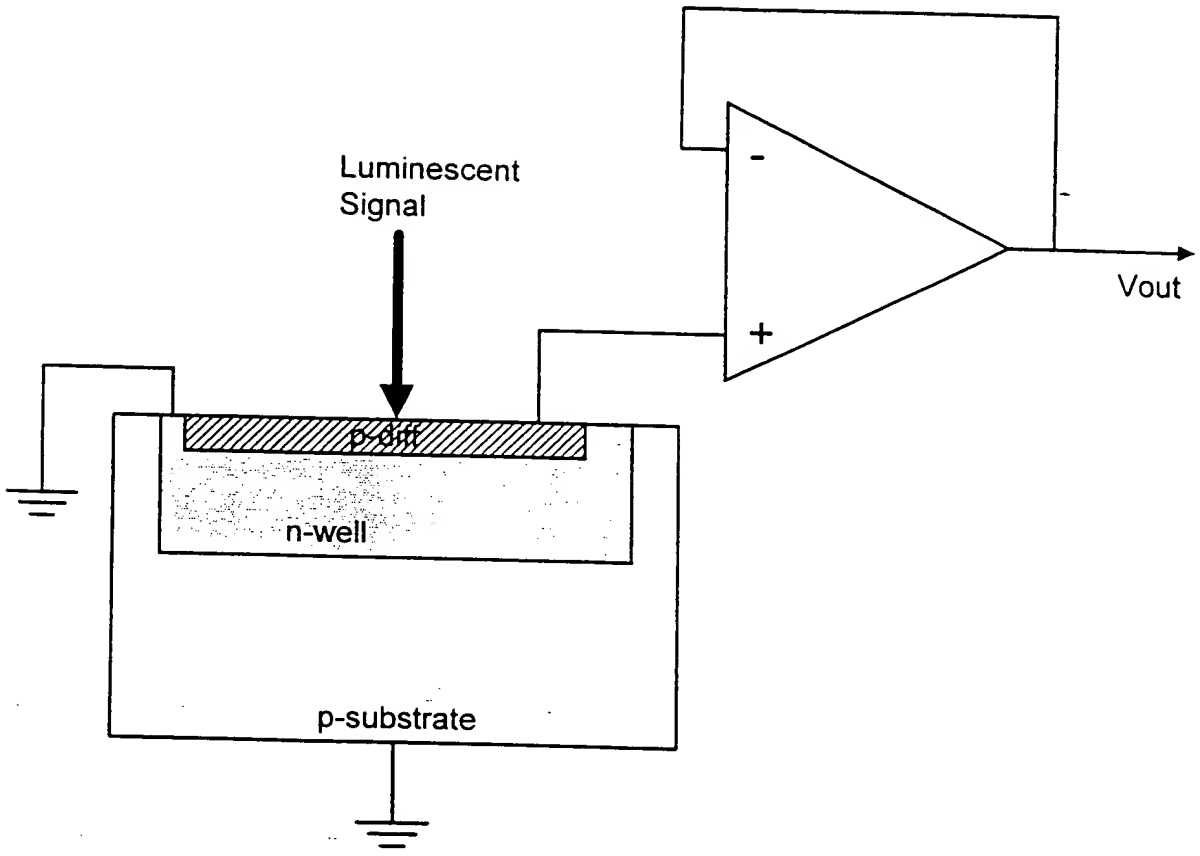


FIG. 7A

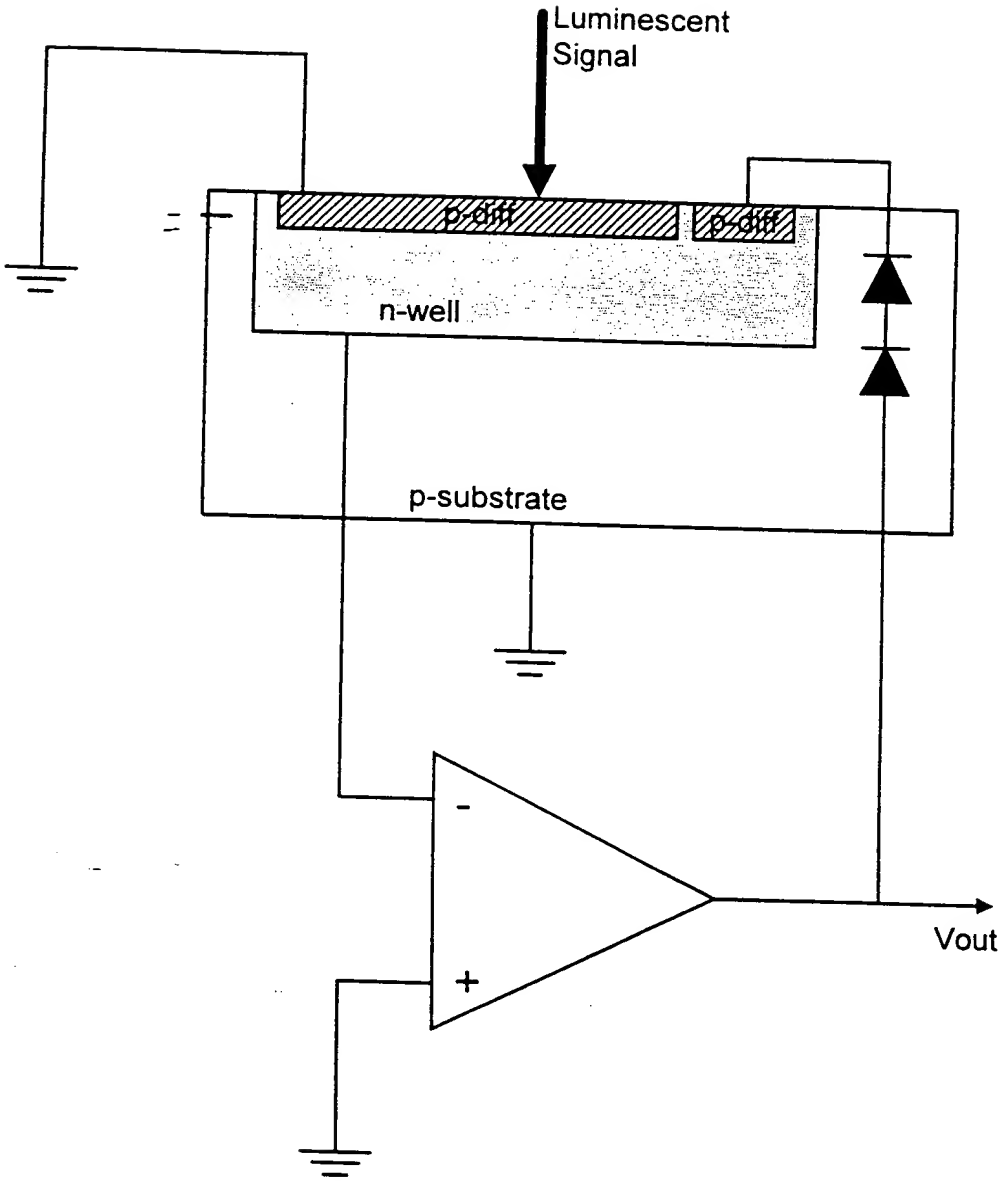


FIG. 7B

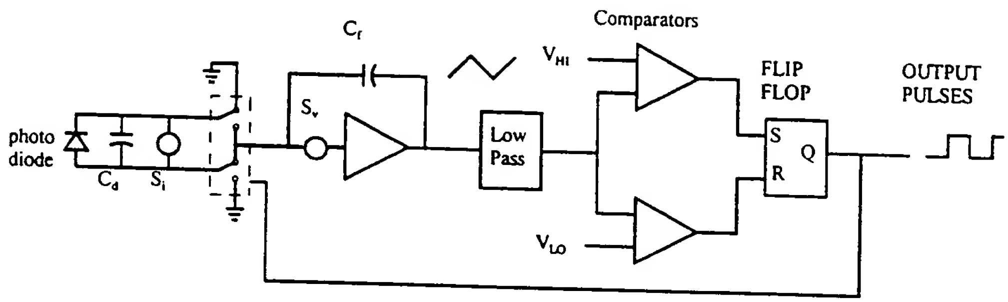


FIG. 7C

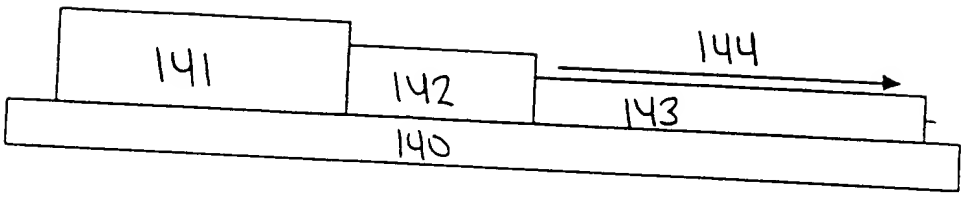


FIG. 8

FIG. 9A

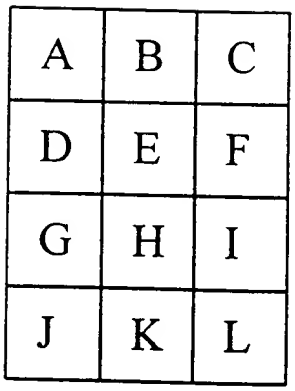


FIG. 9B

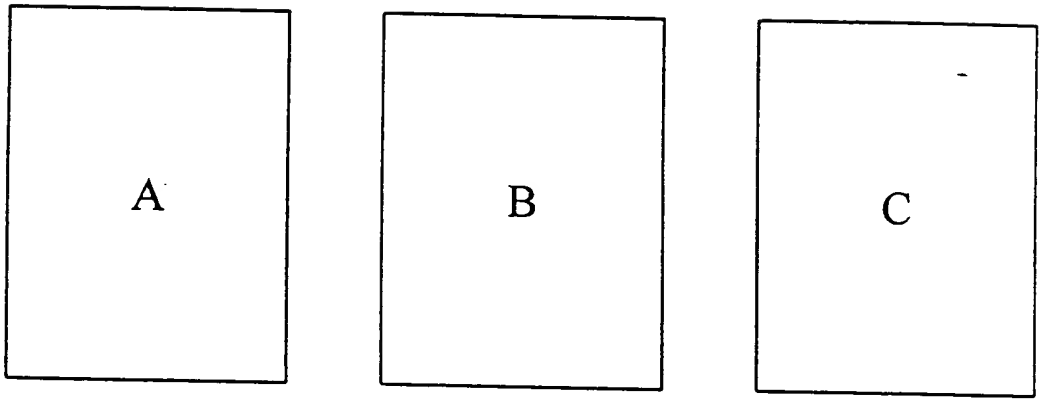


FIG. 9C

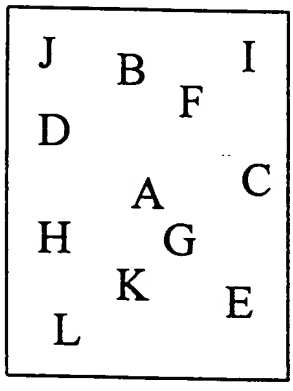
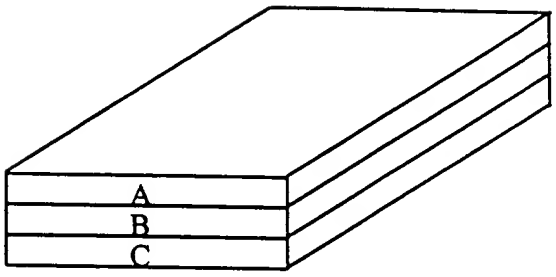
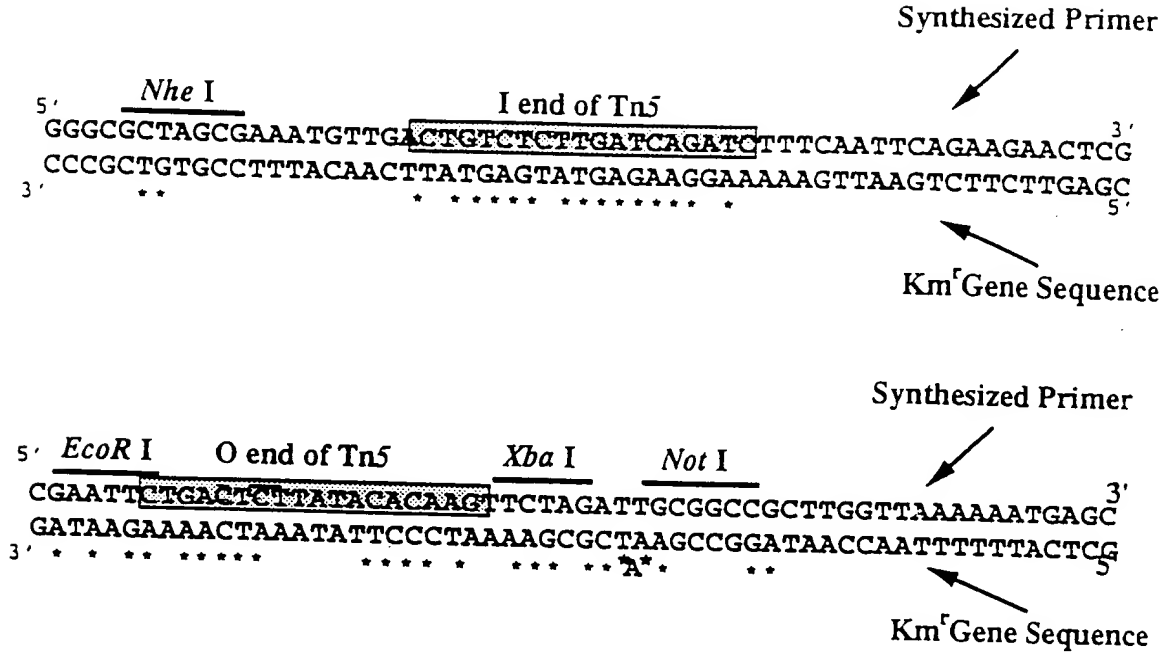


FIG. 9D



Primers for Mini Tn5Km*NX*



Primers for pLJS

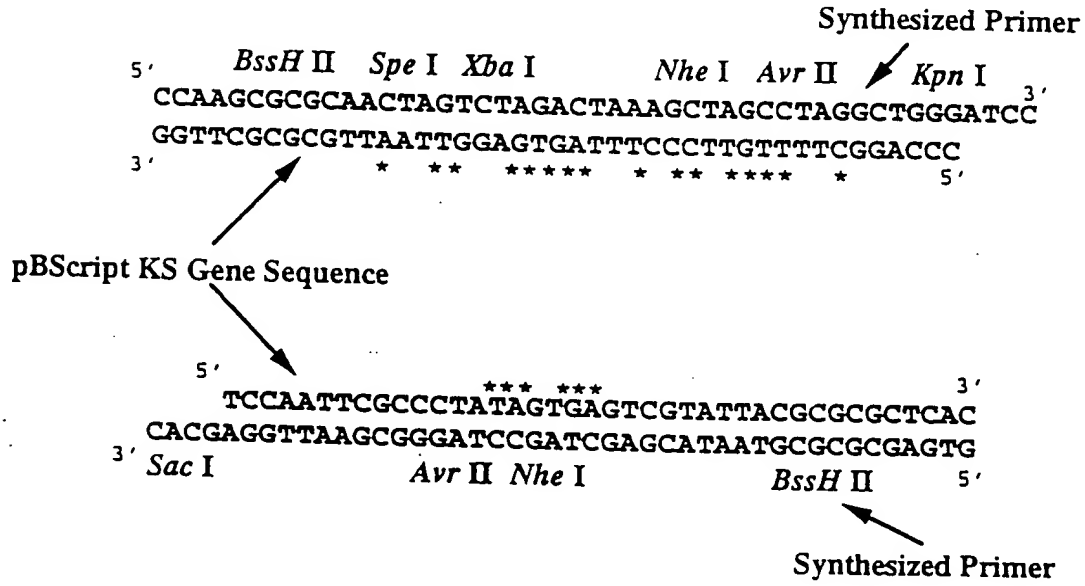


FIG. 10

* Denotes base pair mismatch

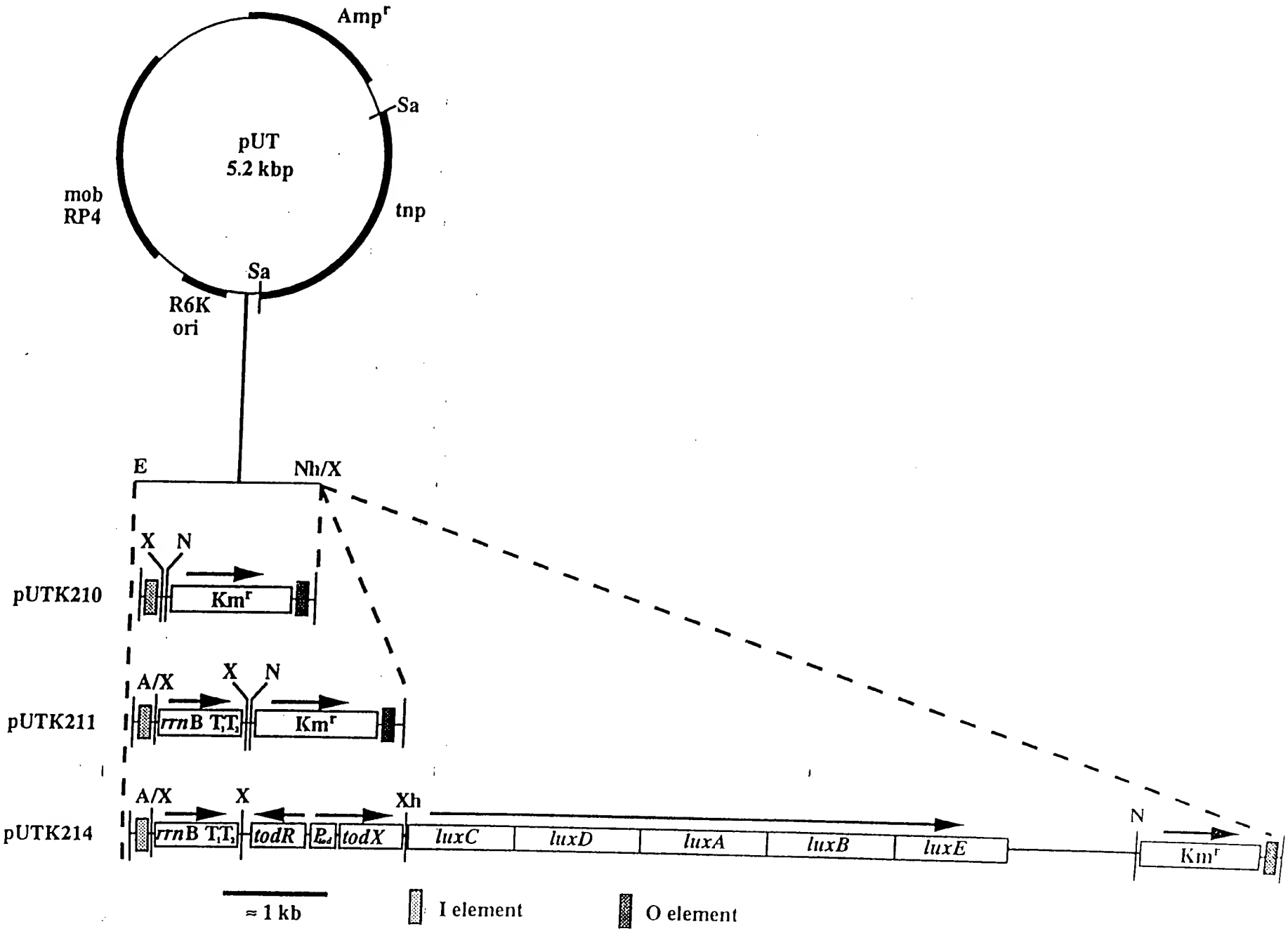

Amp^r
Sa
pUT
5.2 kbp
mob
RP4
tnp
Sa
R6K
ori
E
Nh/X
X
N
pUTK210
Km^r
A/X
X
N
pUTK211
rrnB T1T2
Km^r
A/X
X
Xh
N
pUTK214
rrnB T1T2
todR
P_todX
todX
luxC
luxD
luxA
luxB
luxE
Km^r
≈ 1 kb
I element
O element

FIG. 11

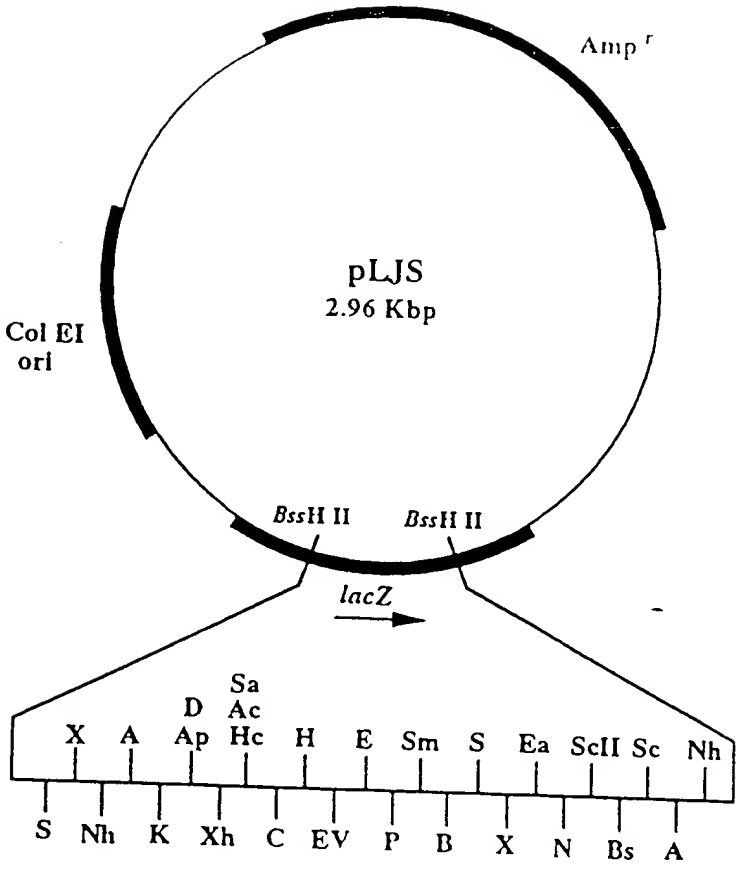


FIG. 12

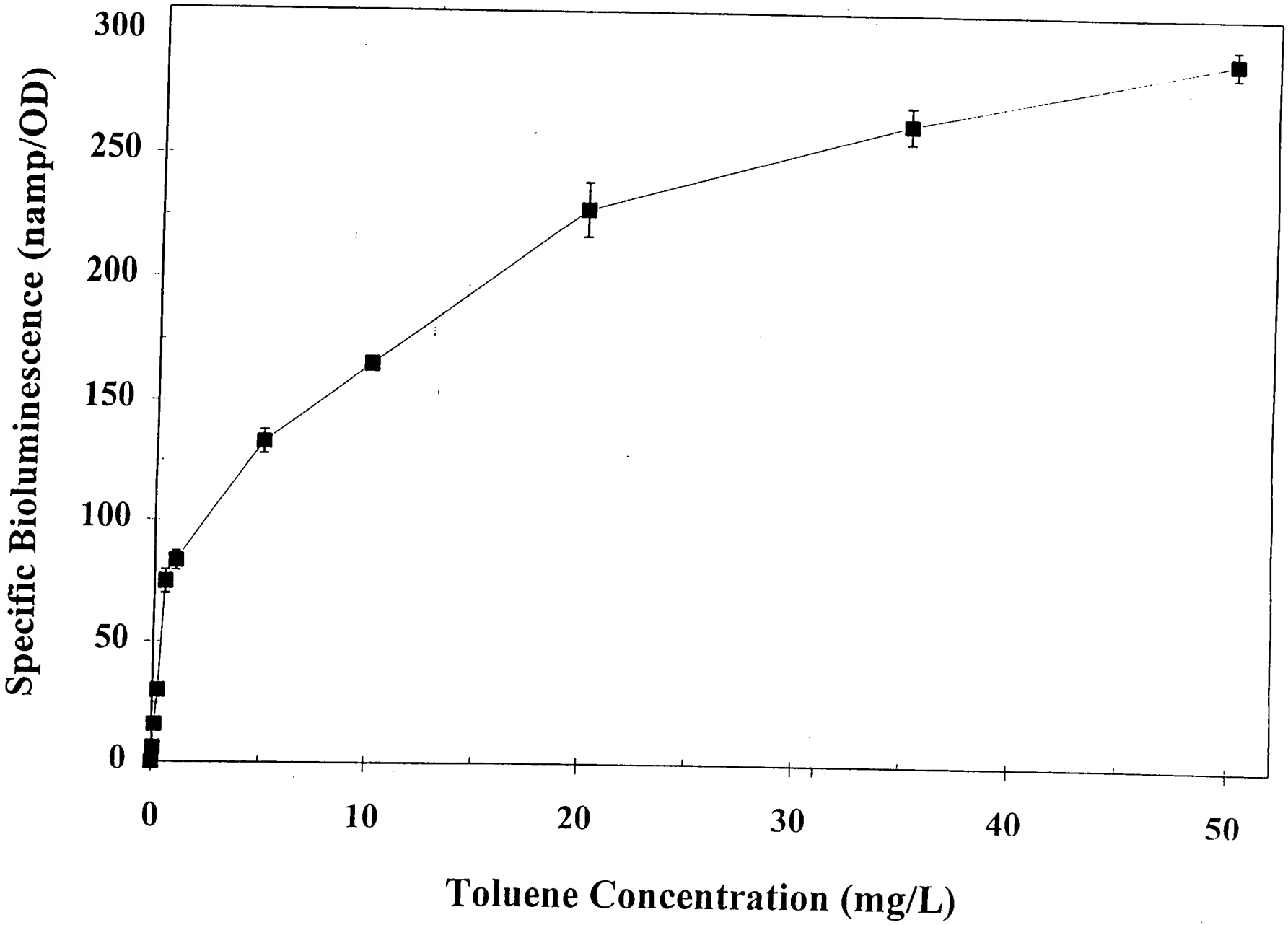


FIG. 13

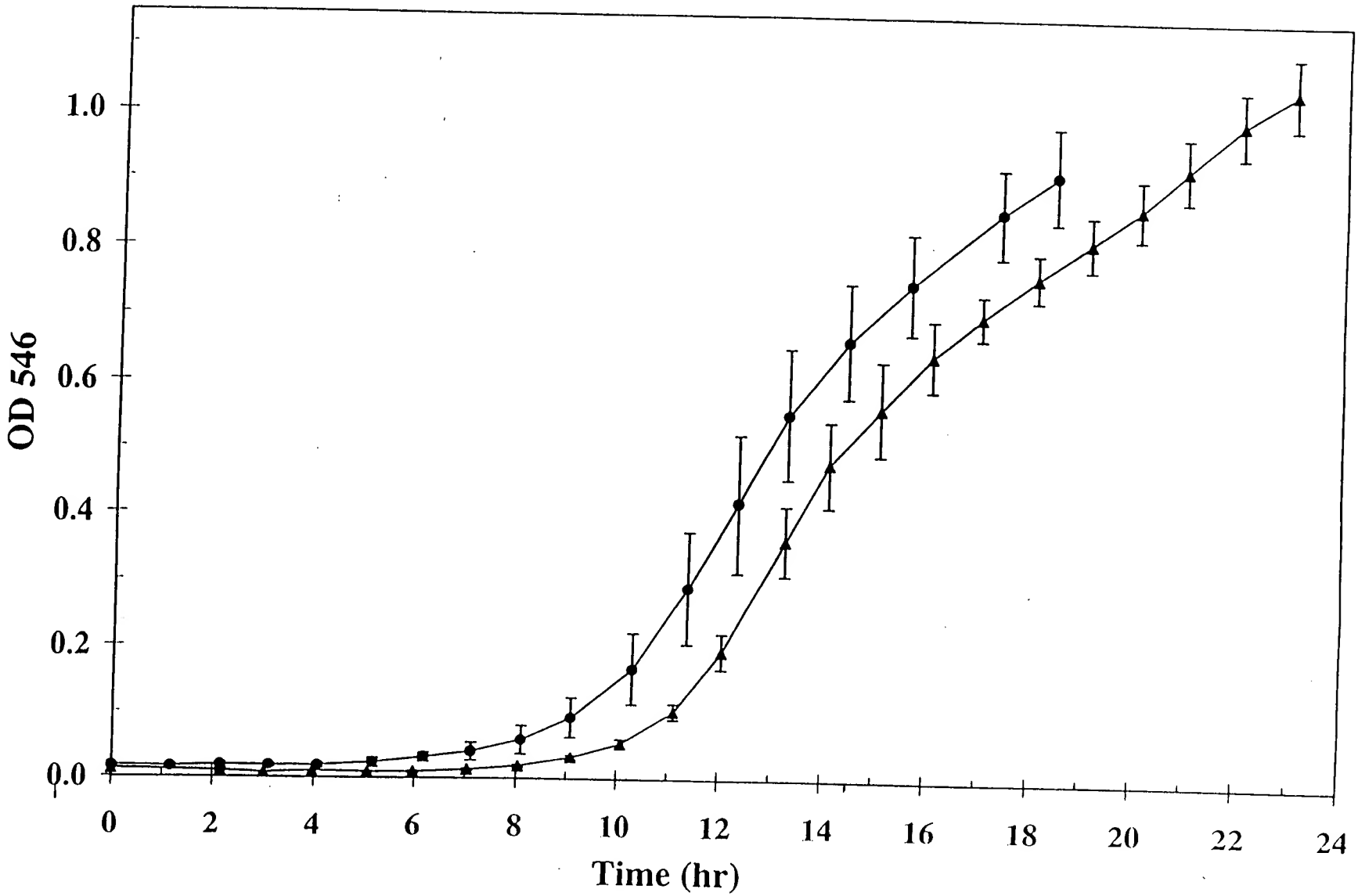


FIG. 14

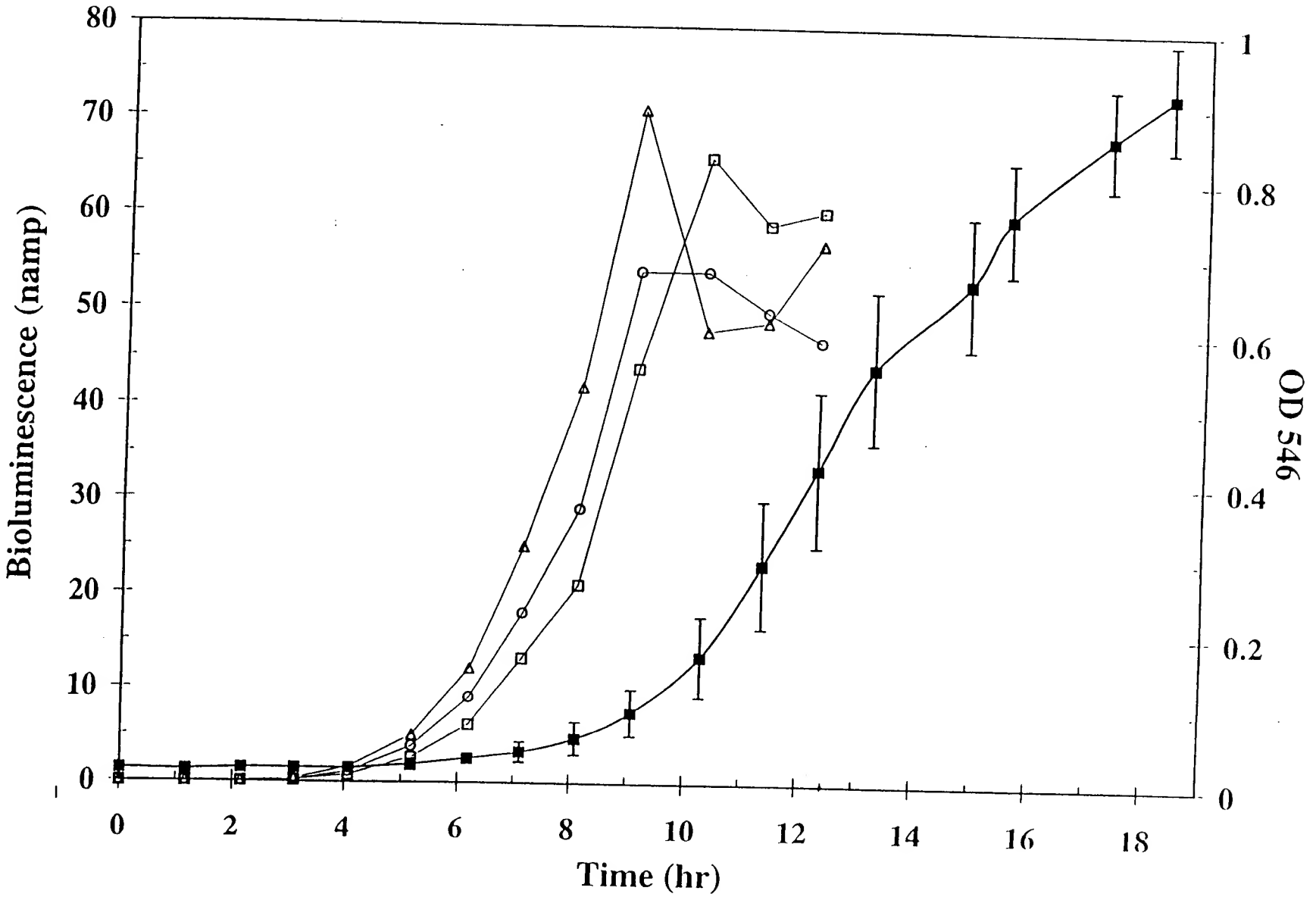

Bioluminescence (namp)
OD 546
Time (hr)
80
70
60
50
40
30
20
10
0
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
14
16
18

FIG. 15

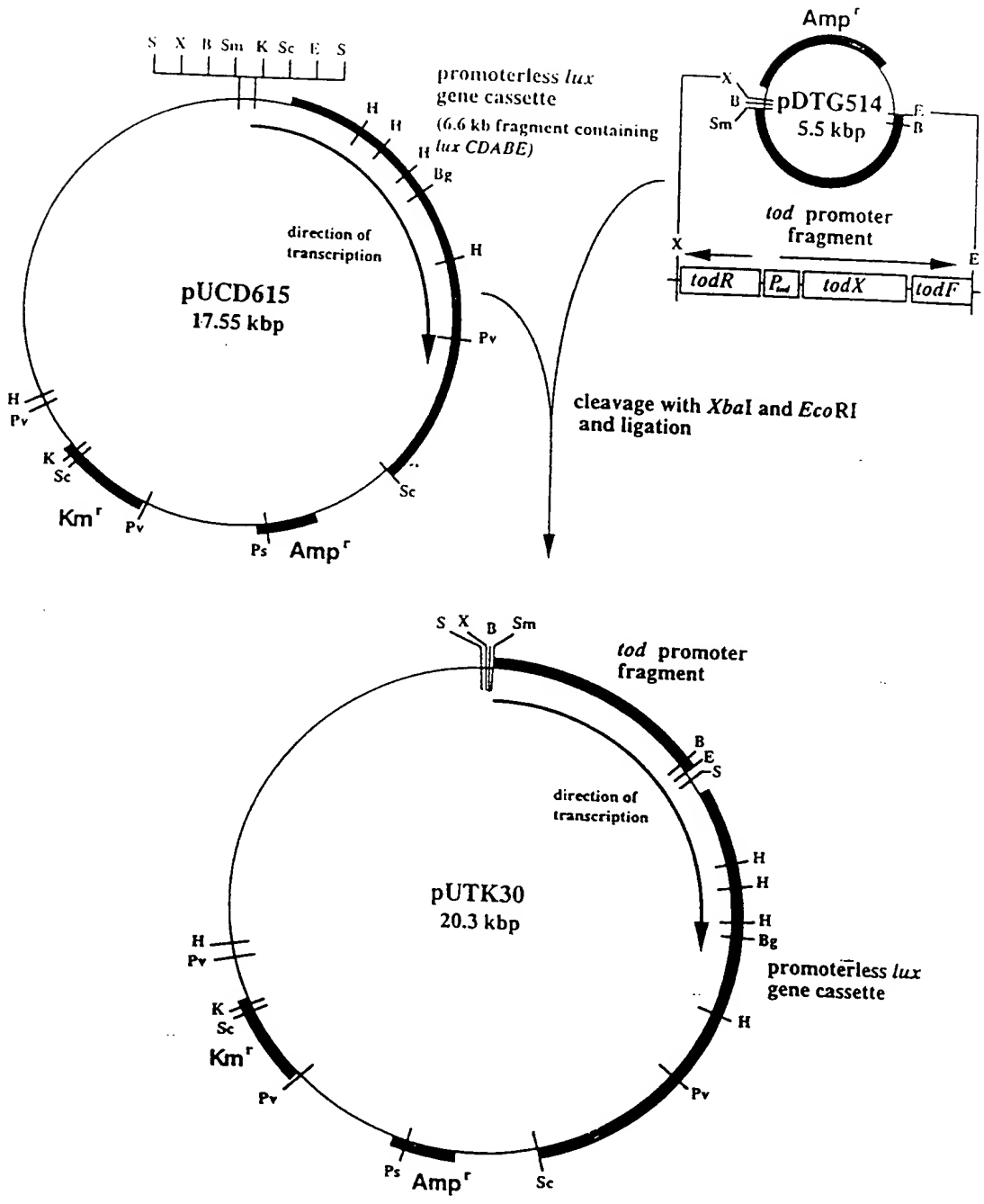


FIG. 16

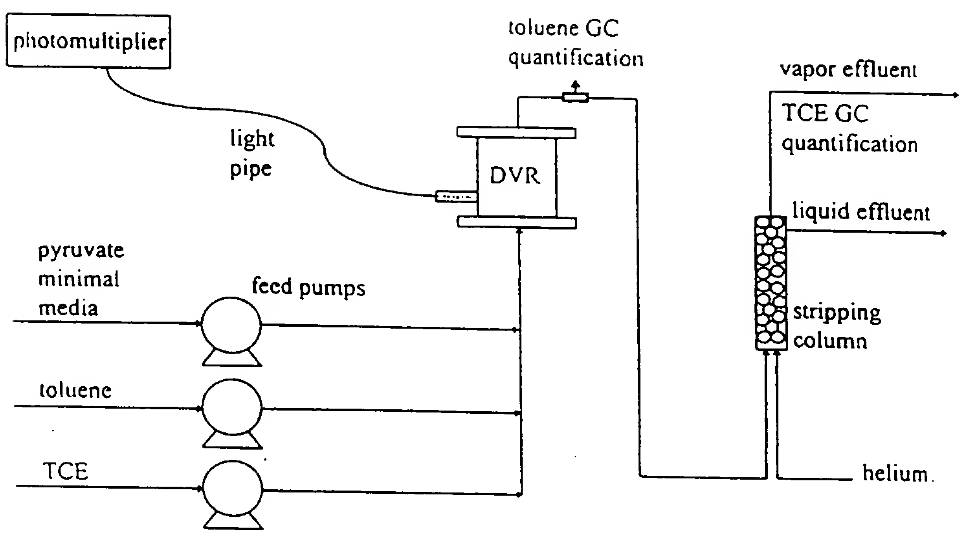

photomultiplier
toluene GC
quantification
vapor effluent
TCE GC
quantification
light
pipe
DVR
liquid effluent
pyruvate
minimal
media
feed pumps
stripping
column
toluene
TCE
helium

FIG. 17

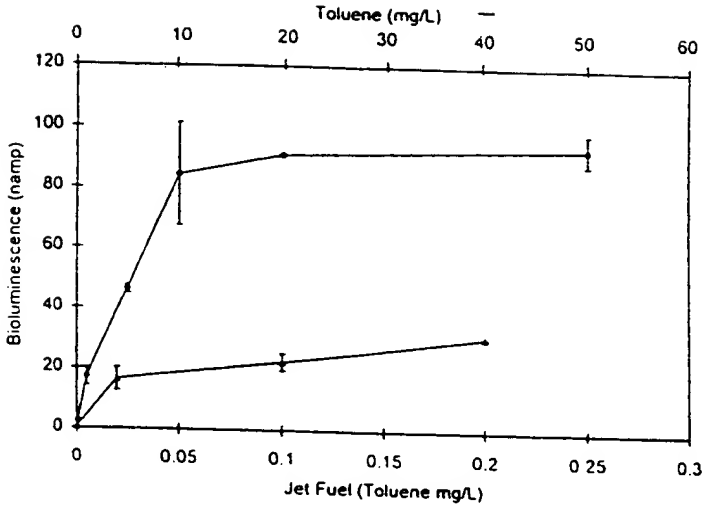

Toluene (mg/L)
0
10
20
30
40
50
60
120
100
80
60
40
20
0
Bioluminescence (namp)
0
0.05
0.1
0.15
0.2
0 25
0.3
Jet Fuel (Toluene mg/L)

FIG. 18

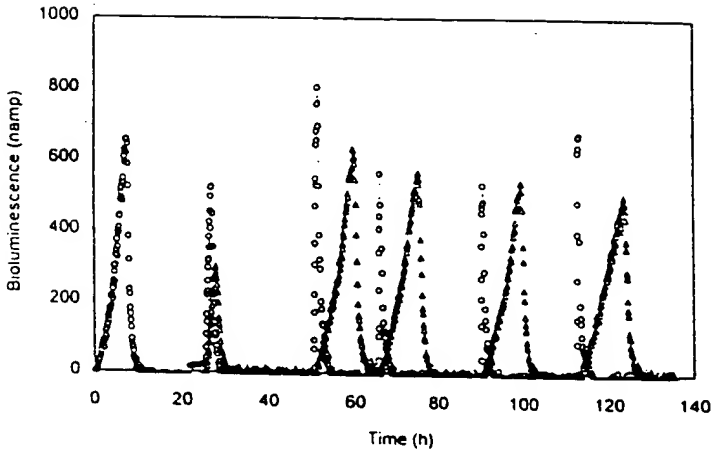

1000
800
600
400
200
0
Bioluminescence (ramp)
0
20
40
60
80
100
120
140
Time (h)

FIG. 19

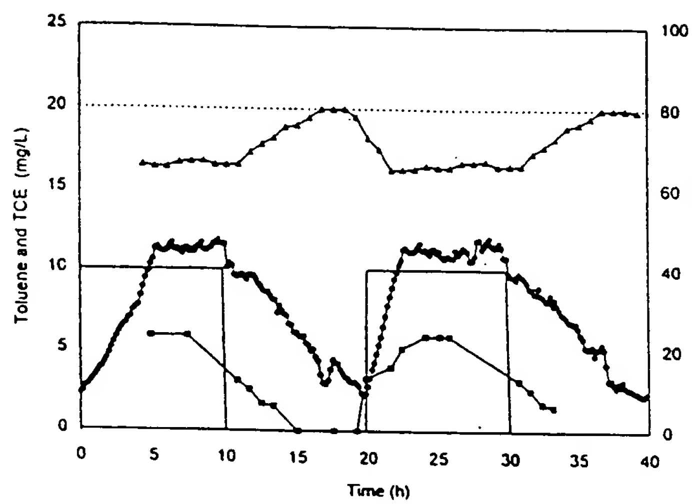


FIG. 20

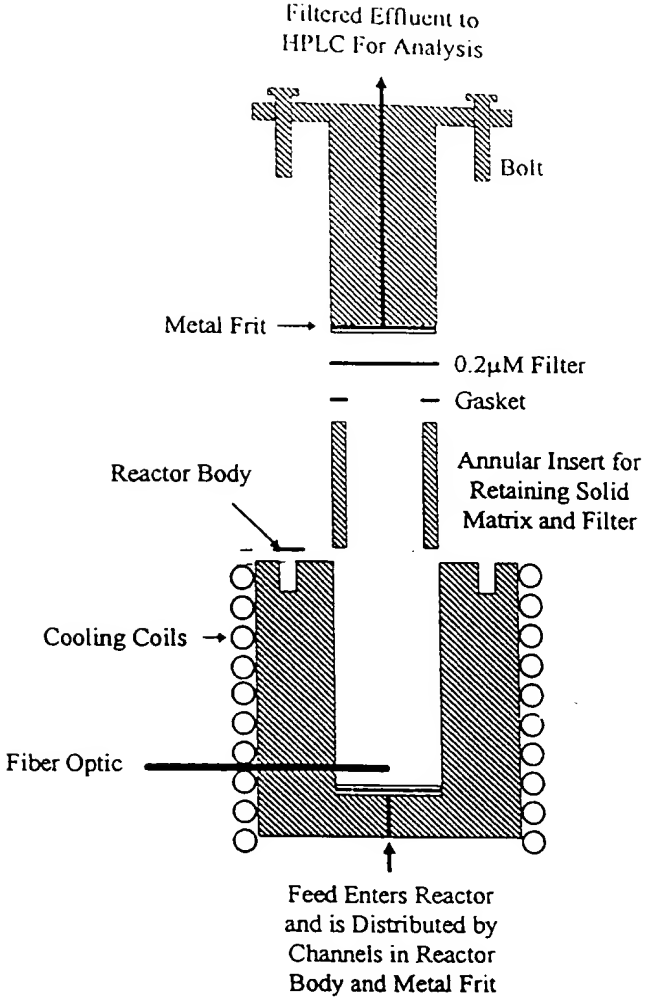


FIG. 21

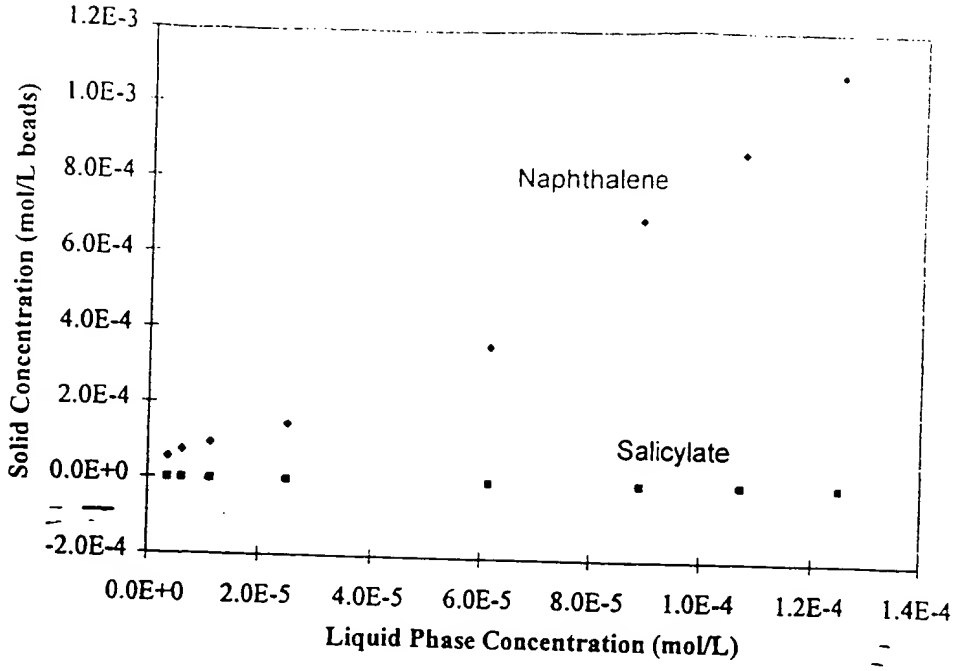


FIG. 22

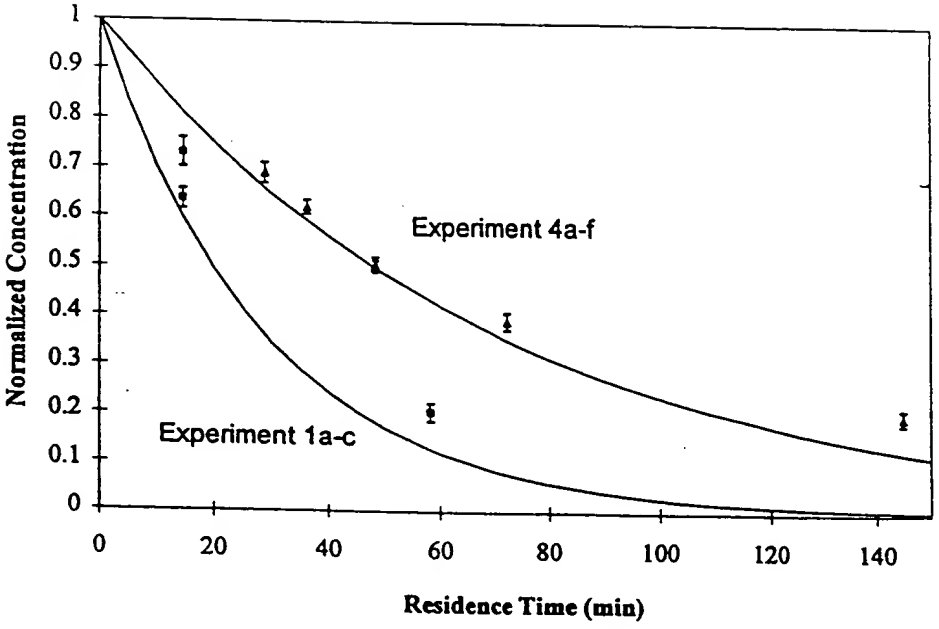


FIG. 23

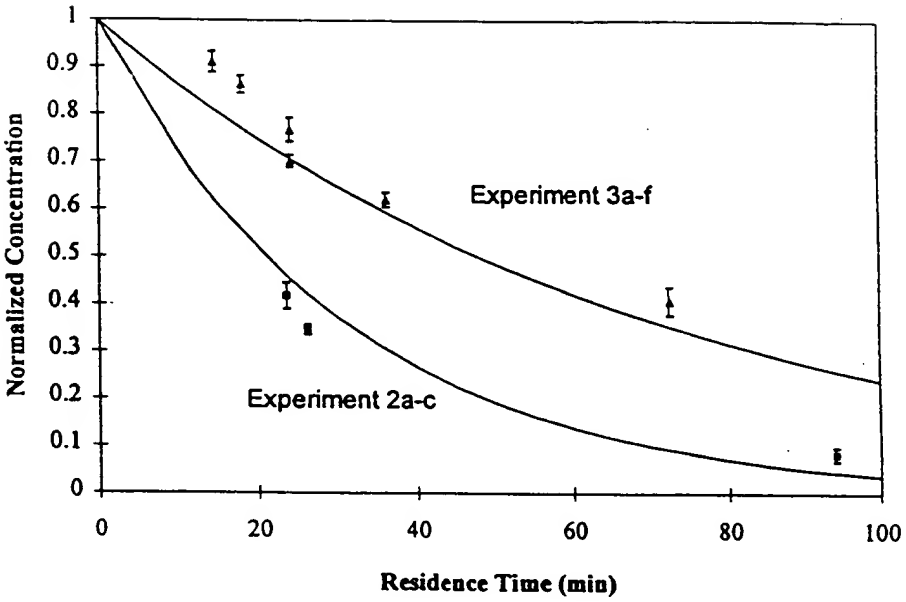

Normalized Concentration
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
Residence Time (min)
Experiment 3a-f
Experiment 2a-c

FIG. 24

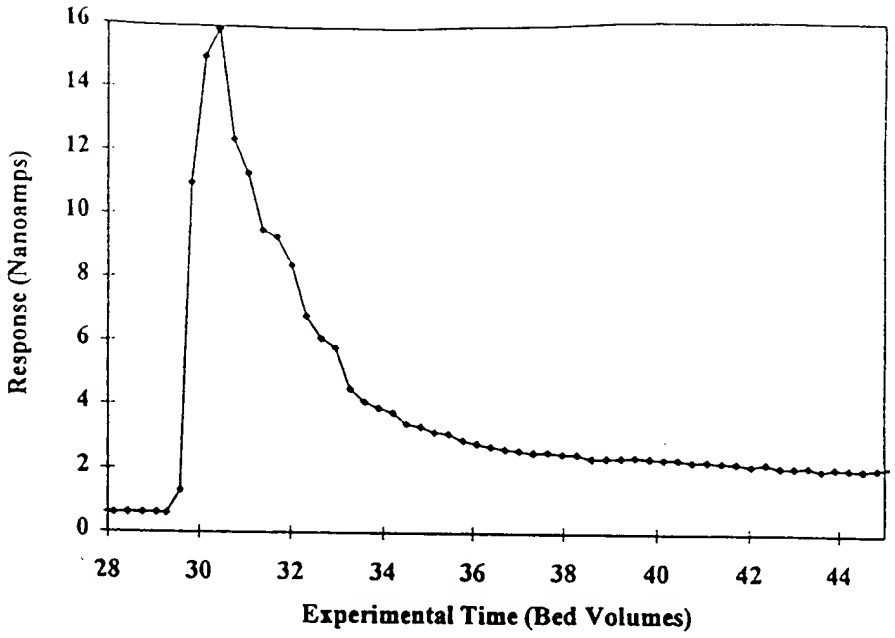

16
14
12
10
8
6
4
2
0
Response (Nanoamps)
28
30
32
34
36
38
40
42
44
Experimental Time (Bed Volumes)

FIG. 25

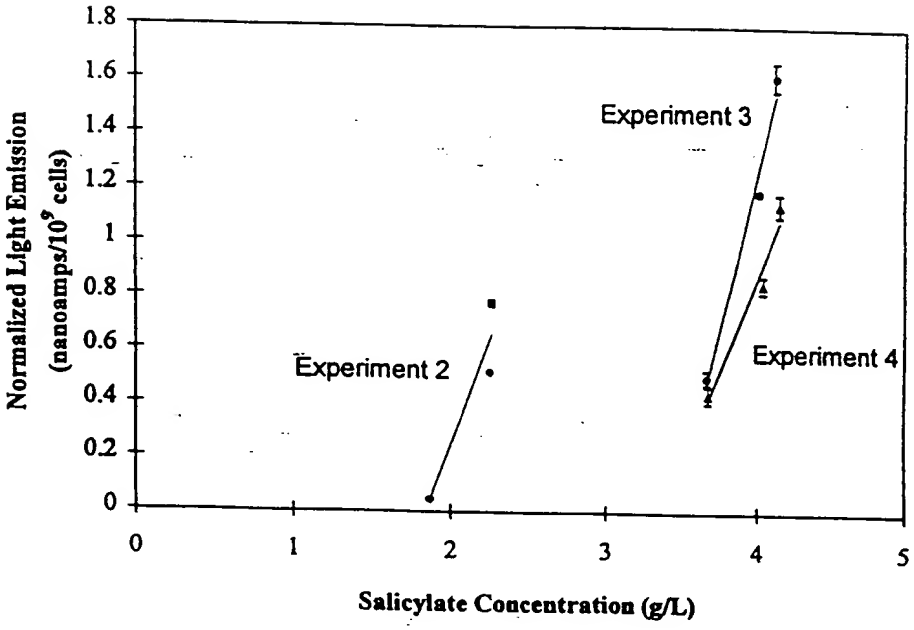

Normalized Light Emission
(nanoamps/10^9 cells)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
Salicylate Concentration (g/L)
Experiment 2
Experiment 3
Experiment 4

FIG. 26

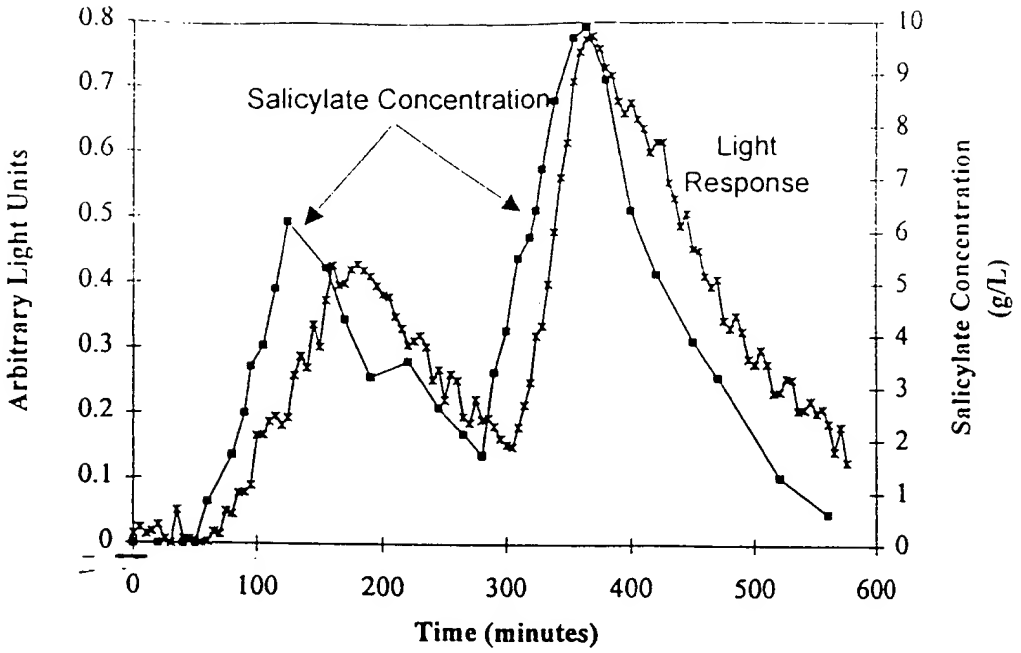

Arbitrary Light Units
Salicylate Concentration (g/L)
Time (minutes)
Salicylate Concentration
Light Response
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
9
8
7
6
5
4
3
2
1
0
0
100
200
300
400
500
600

FIG. 27

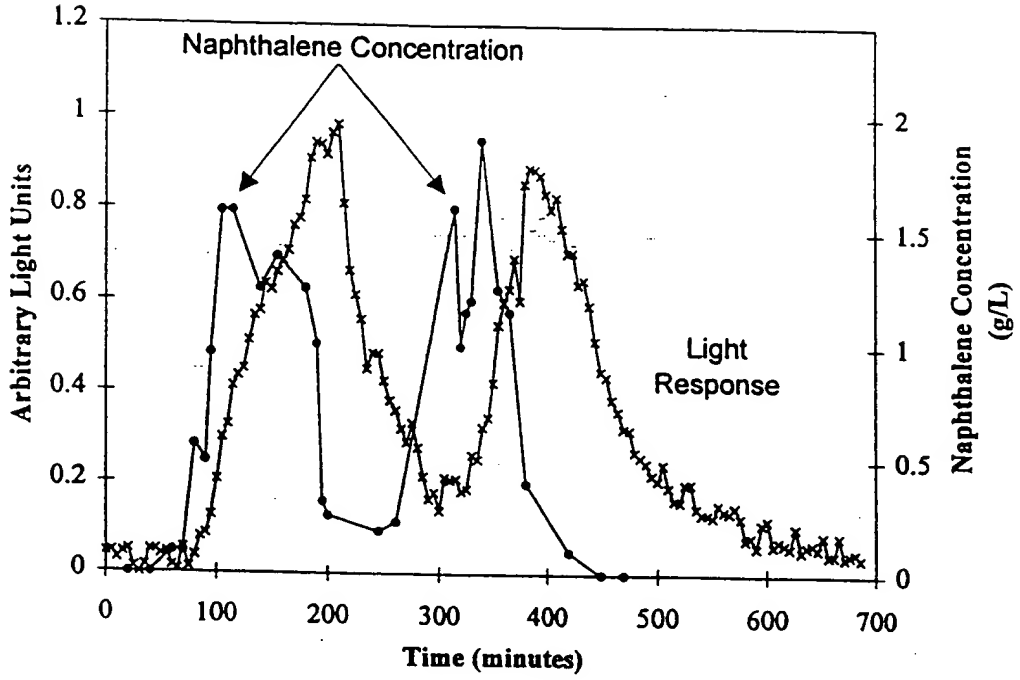

Naphthalene Concentration
Light Response
Arbitrary Light Units
Naphthalene Concentration (g/L)
Time (minutes)
1.2
1
0.8
0.6
0.4
0.2
0
2
1.5
1
0.5
0
0
100
200
300
400
500
600
700

FIG. 28

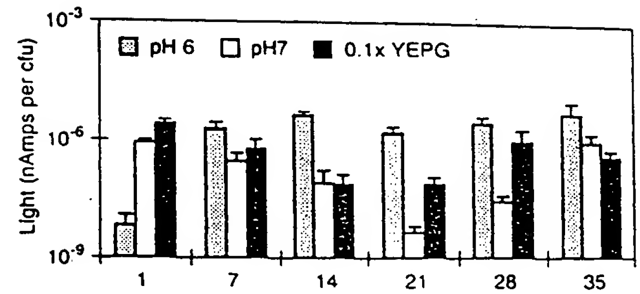


FIG. 29A

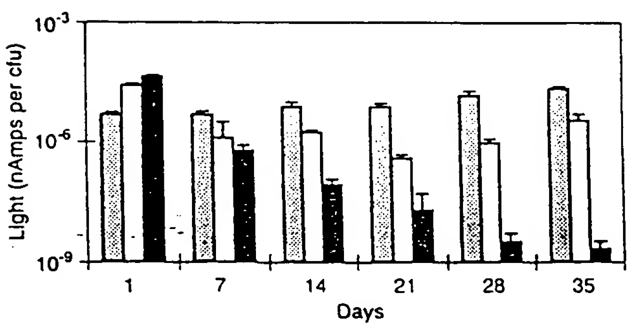


FIG. 29B

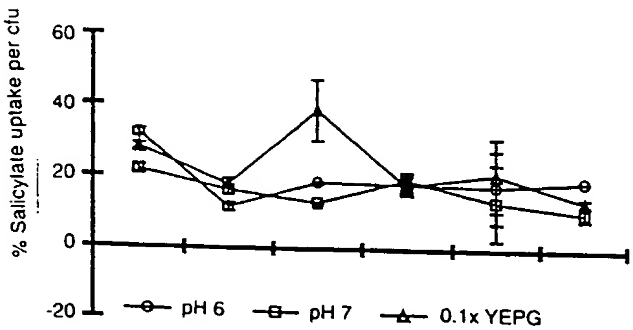


FIG. 30A

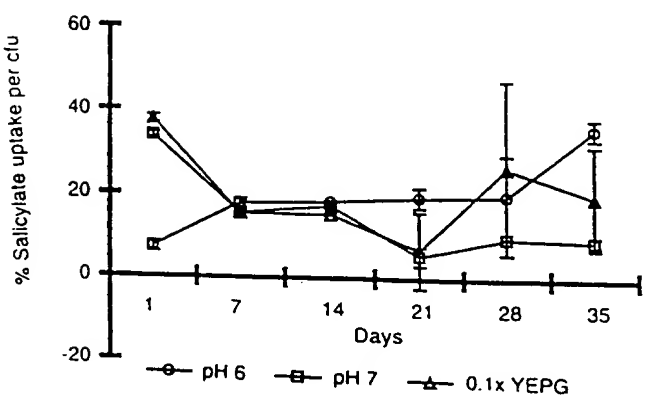


FIG. 30B

Fig. 3 Population of HK44 in alginate beads. The logarithm of the number of colony-forming units/alginate beads is shown

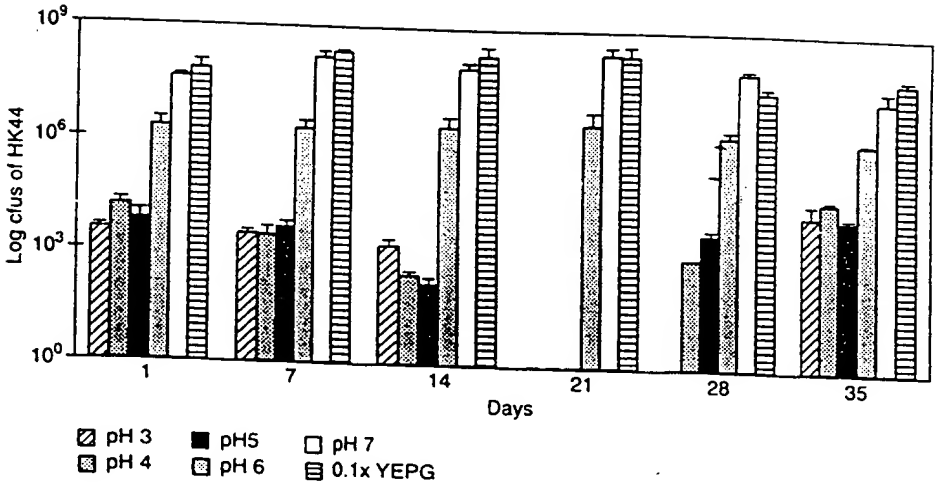


FIG. 31

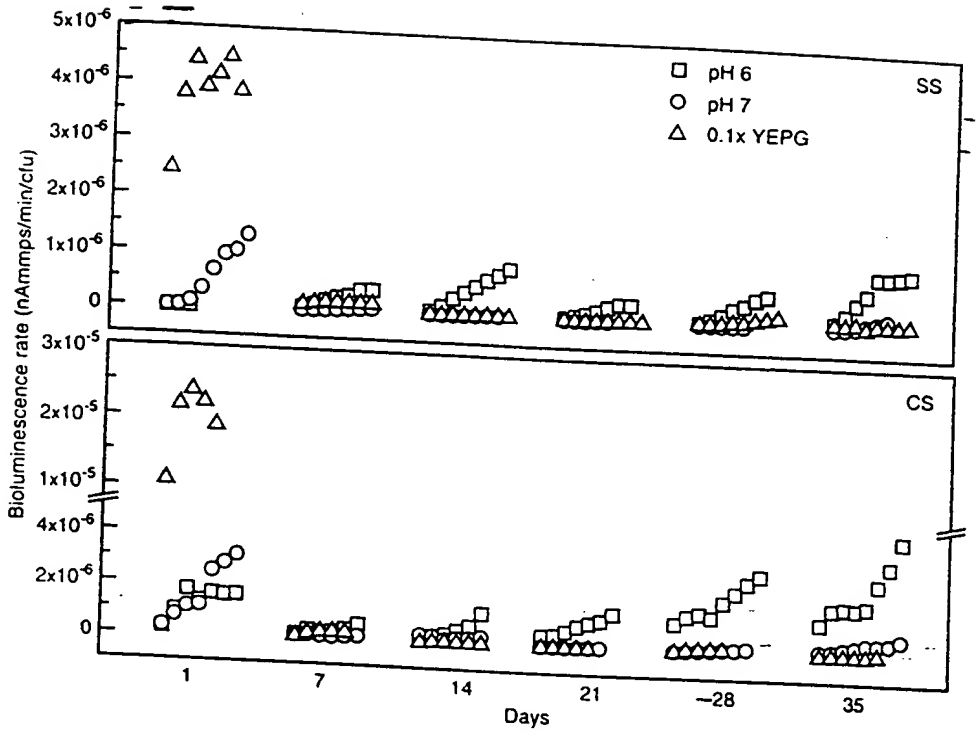

5x10-6
4x10-6
3x10-6
2x10-6
1x10-6
0
3x10-5
2x10-5
1x10-5
4x10-6
2x10-6
0
Bioluminescence rate (nAmmps/min/clu)
pH 6
pH 7
0.1x YEPG
SS
CS
1
7
14
21
-28
35
Days

FIG. 32

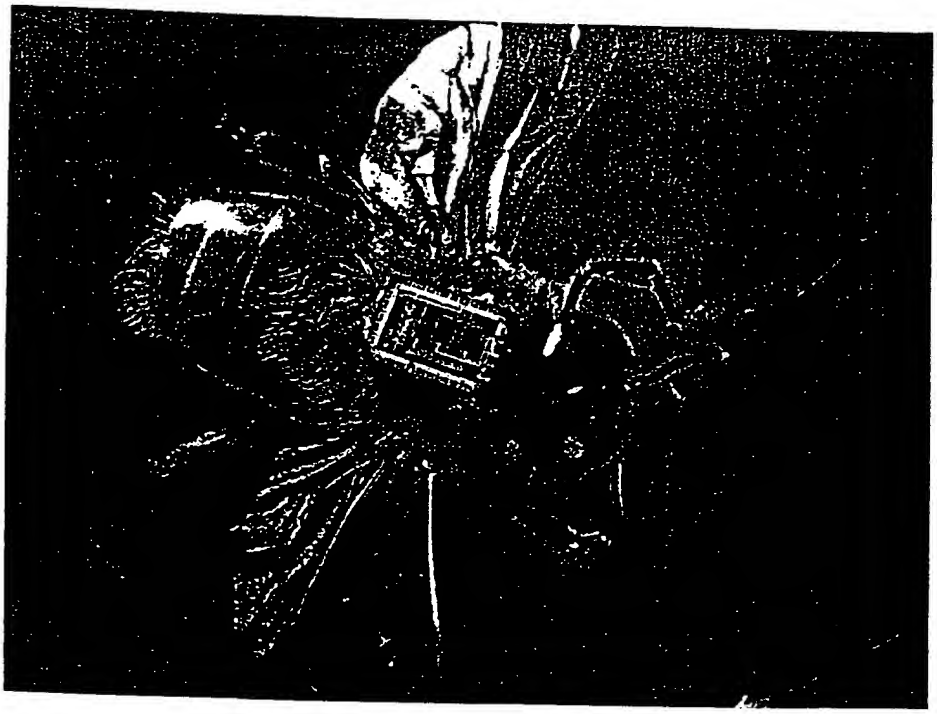
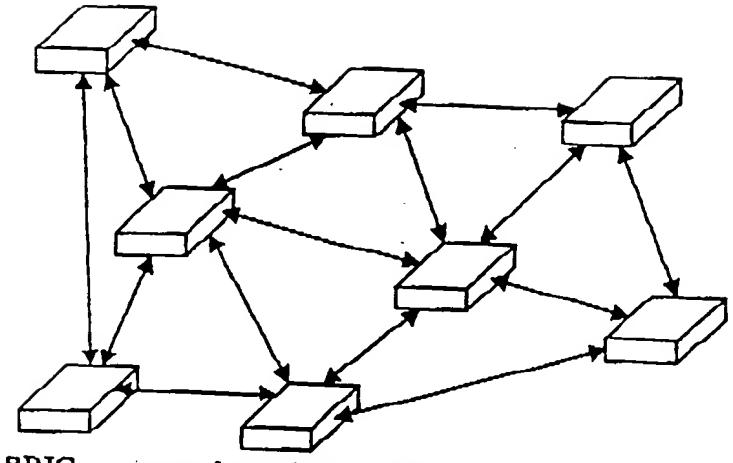


FIG. 33



BBICs connected together in a distributed neural network

FIG. 34

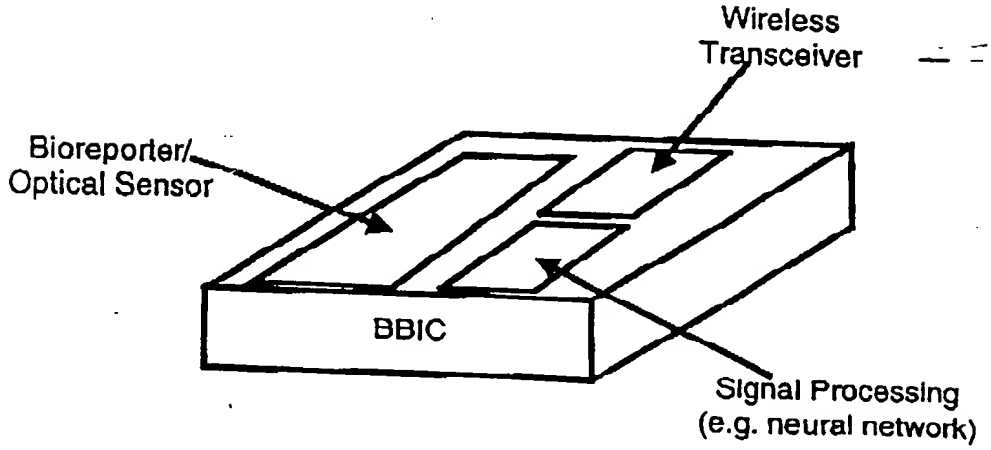


FIG. 35

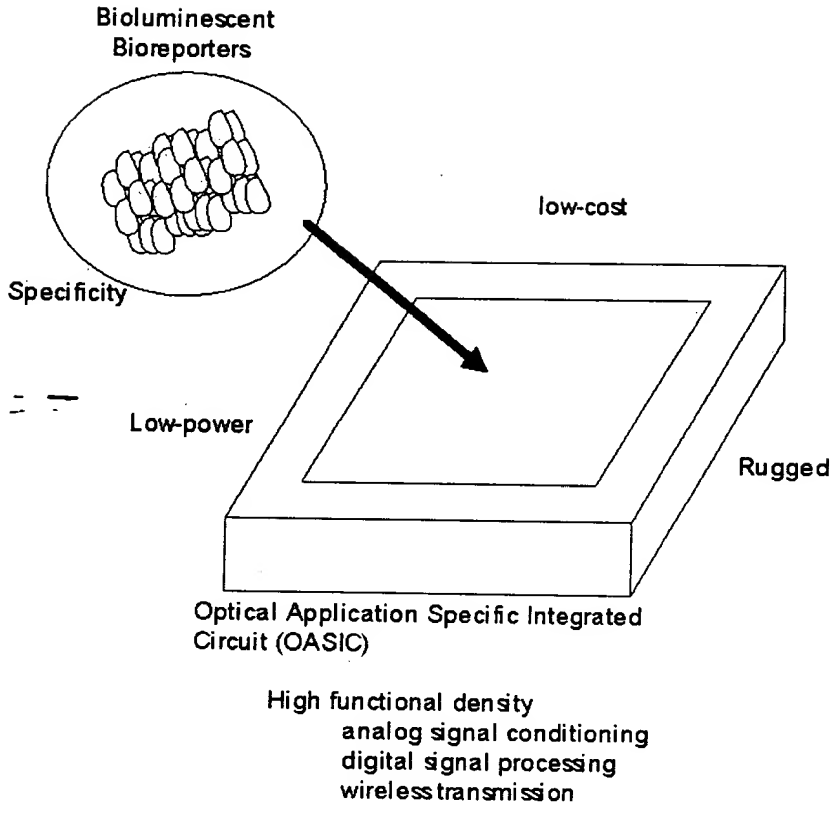

Bioluminescent
Bioreporters
low-cost
Specificity
Low-power
Rugged
Optical Application Specific Integrated
Circuit (OASIC)
High functional density
analog signal conditioning
digital signal processing
wireless transmission

FIG. 36

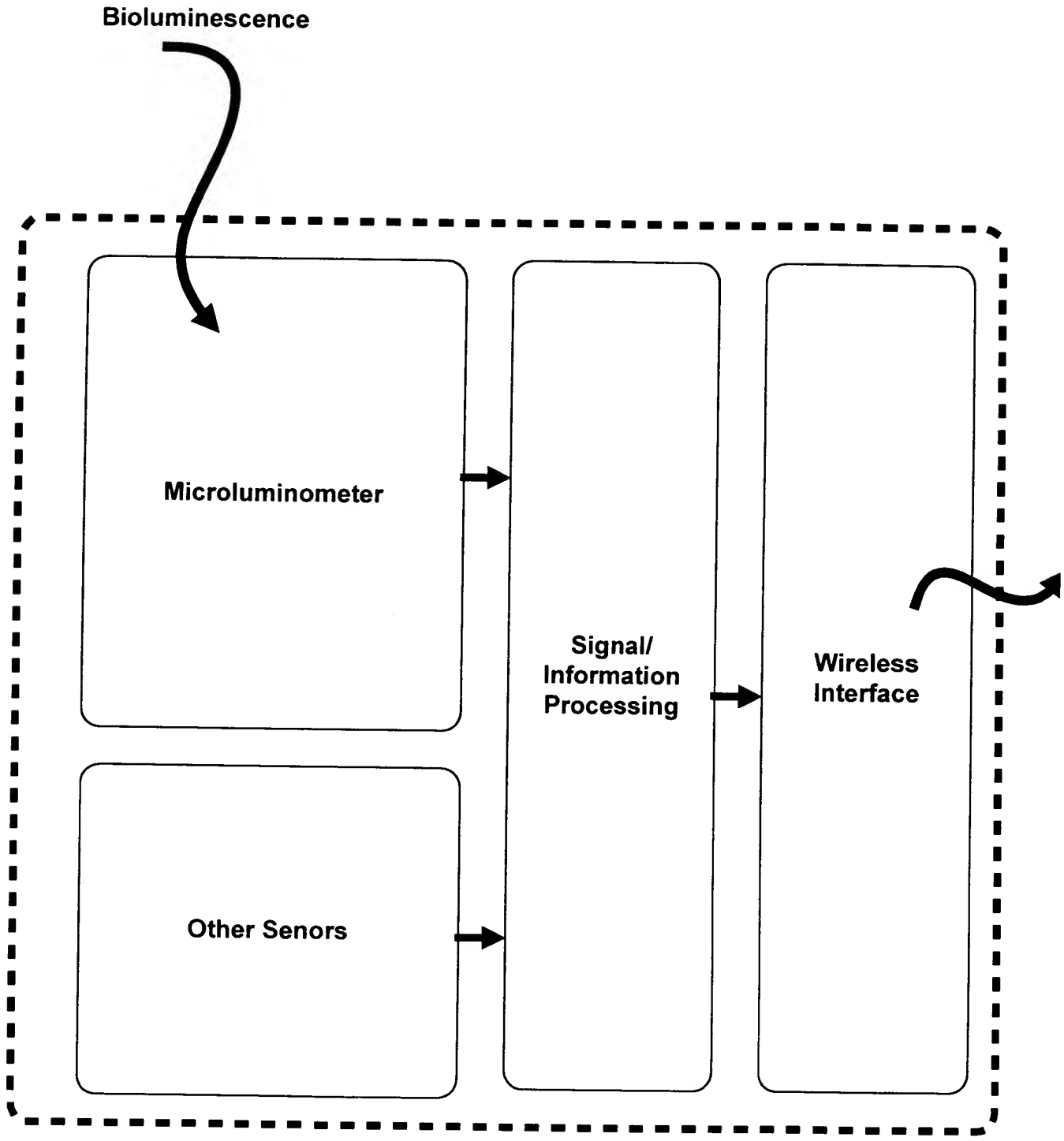

Bioluminescence
Microluminometer
Other Senors
Signal/
Information
Processing
Wireless
Interface

FIG. 37

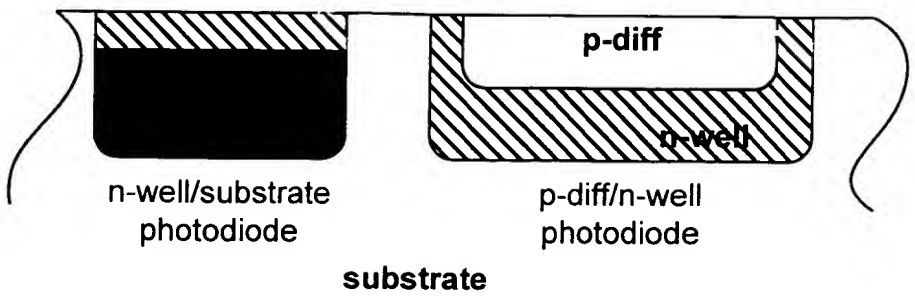


FIG. 38

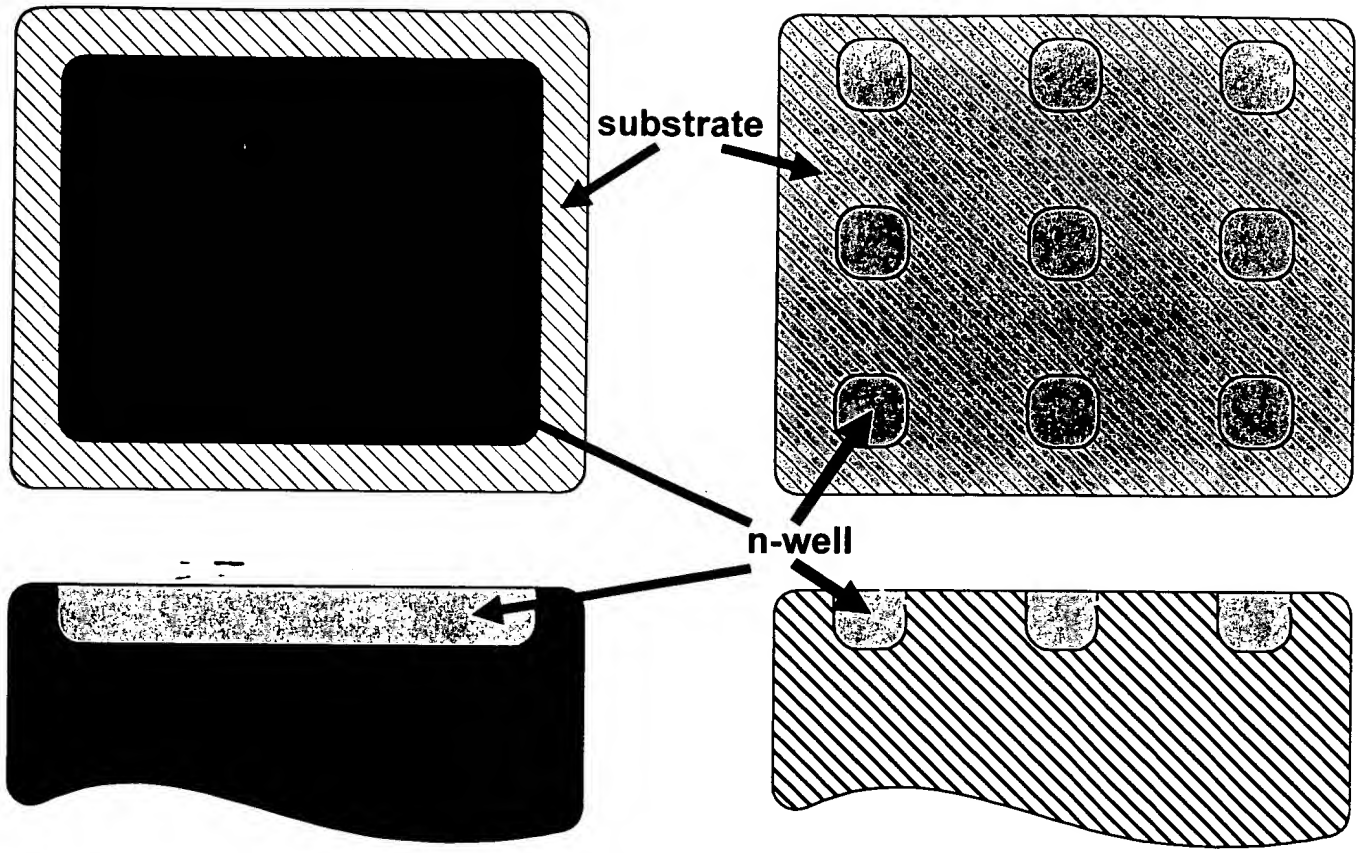


FIG. 39

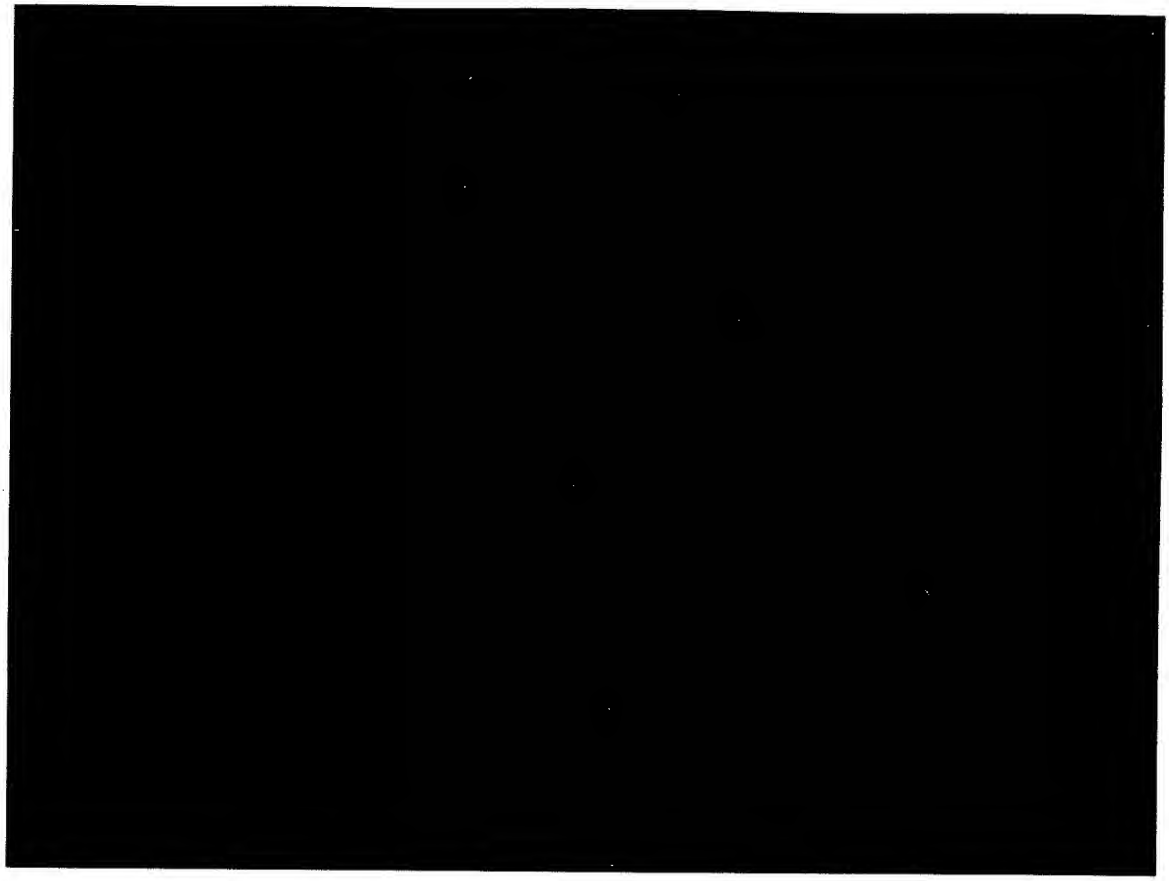


FIG. 40

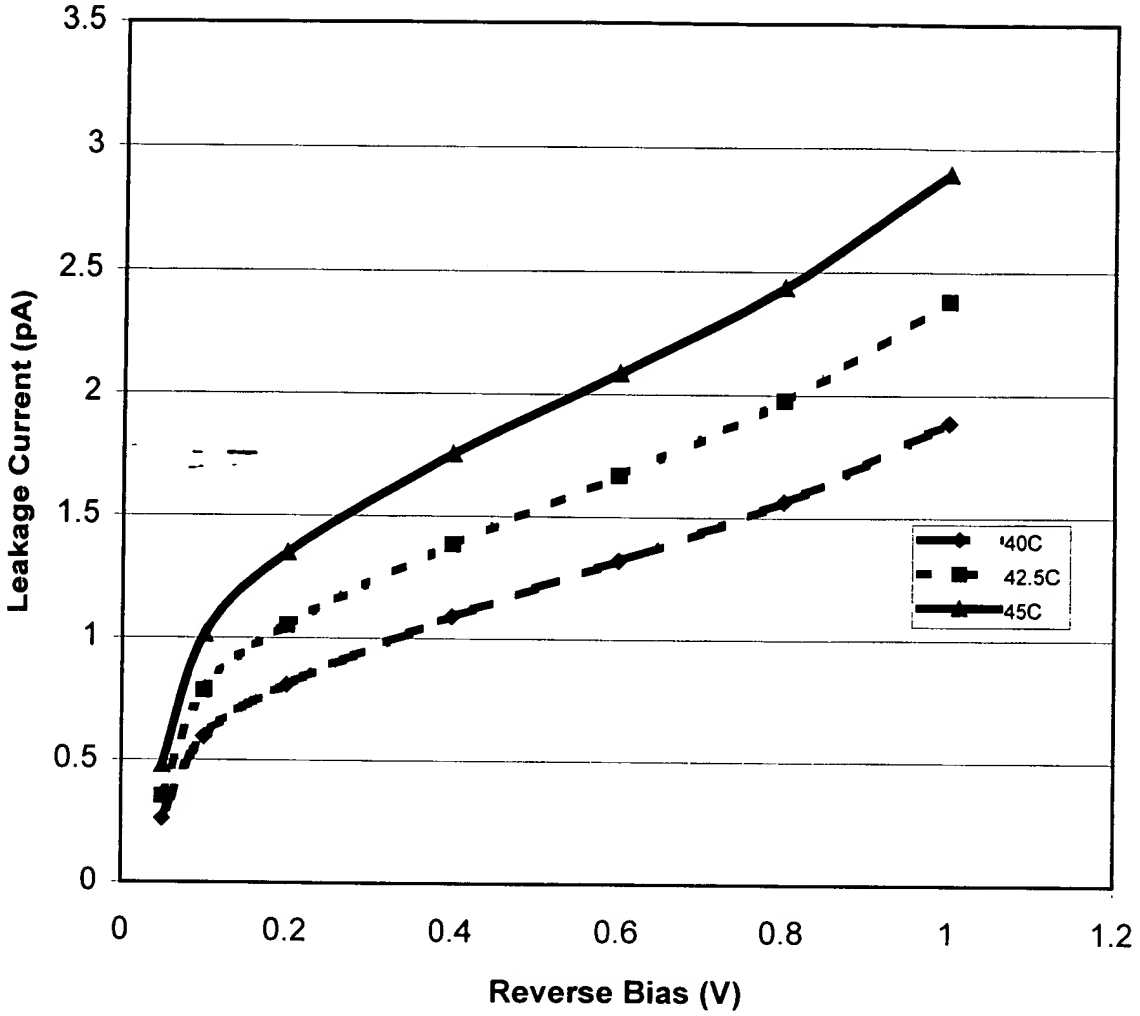


FIG. 41

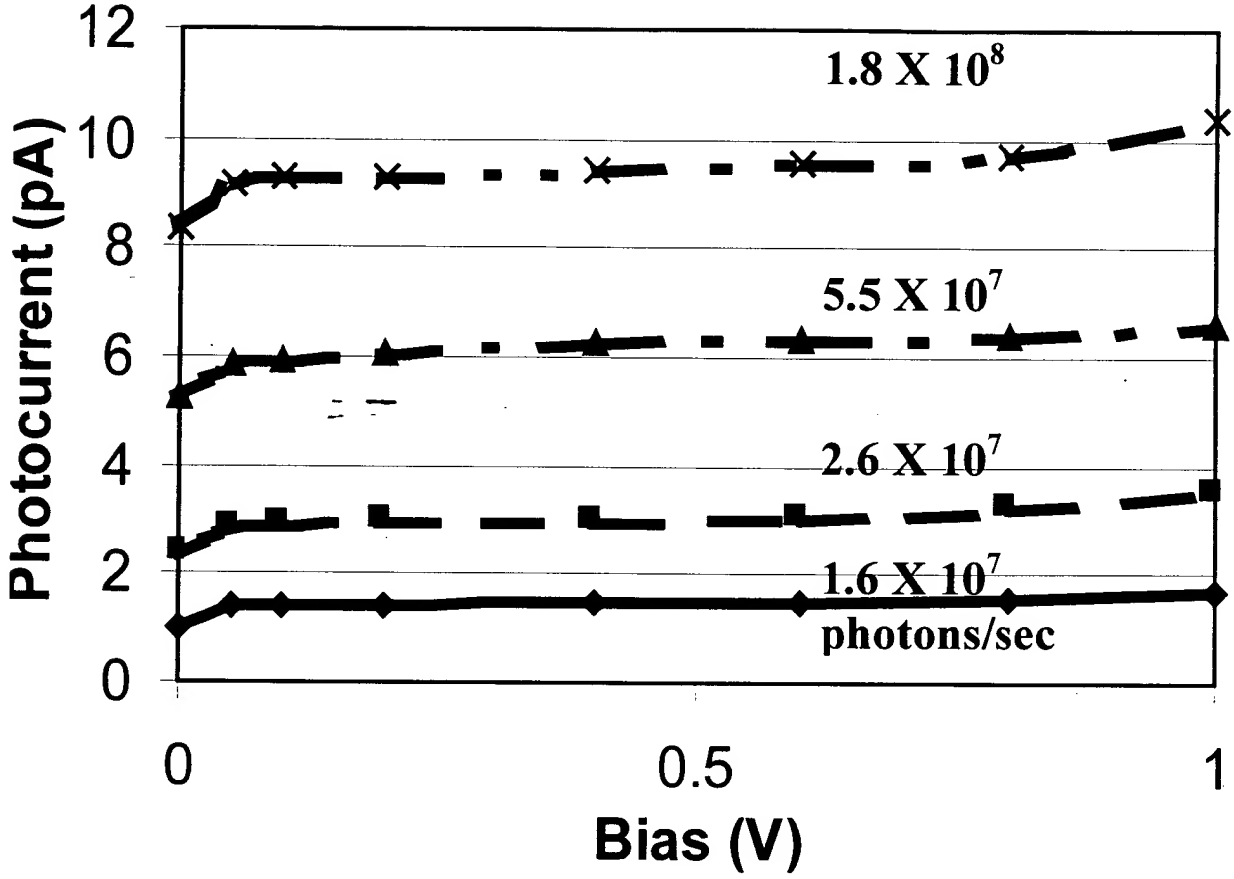

12
10
8
6
4
2
0
Photocurrent (pA)
1.8 X 10^8
5.5 X 10^7
2.6 X 10^7
1.6 X 10^7
photons/sec
0
0.5
1
Bias (V)

FIG. 42

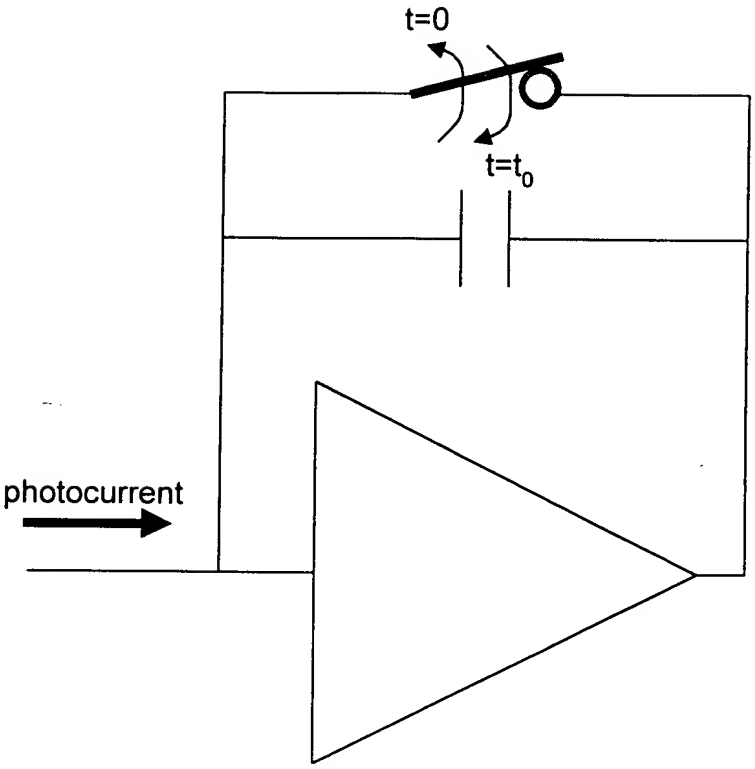


FIG. 43

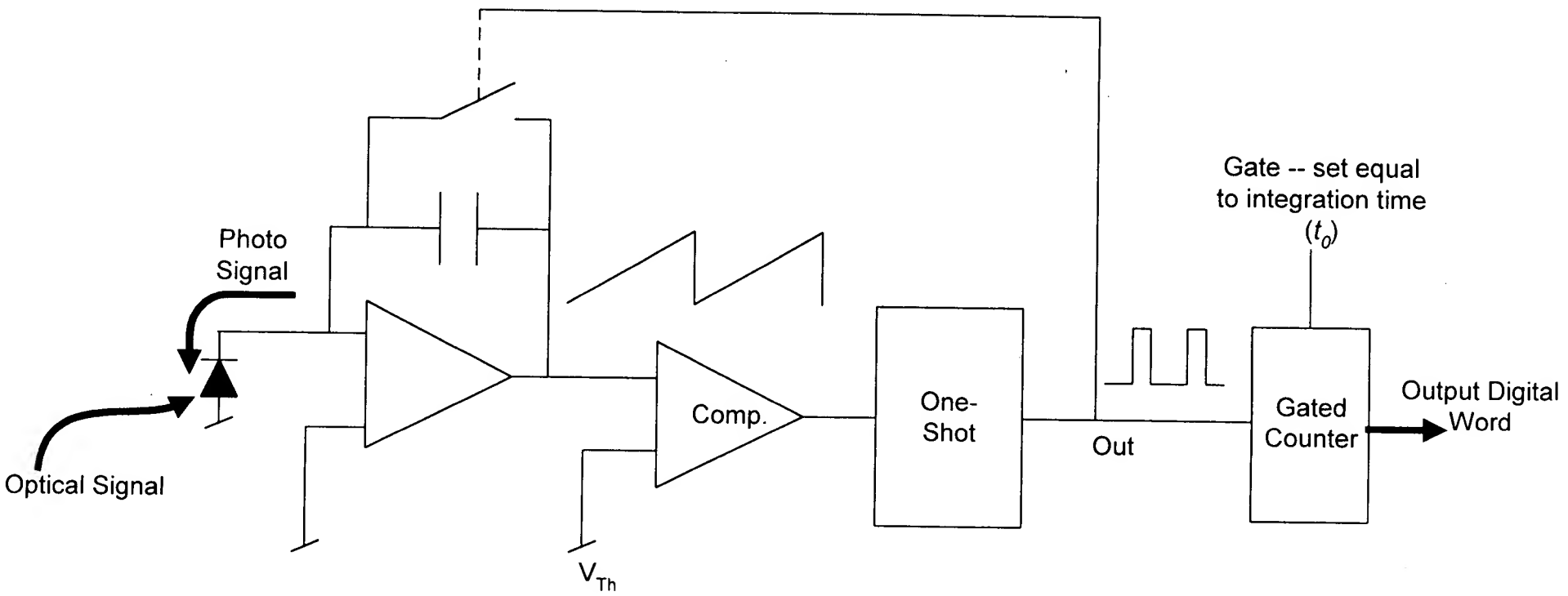


Photo
Signal
Optical Signal
Comp.
V_{Th}
One-
Shot
Out
Gate -- set equal
to integration time
(t_0)
Gated
Counter
Output Digital
Word

FIG. 44

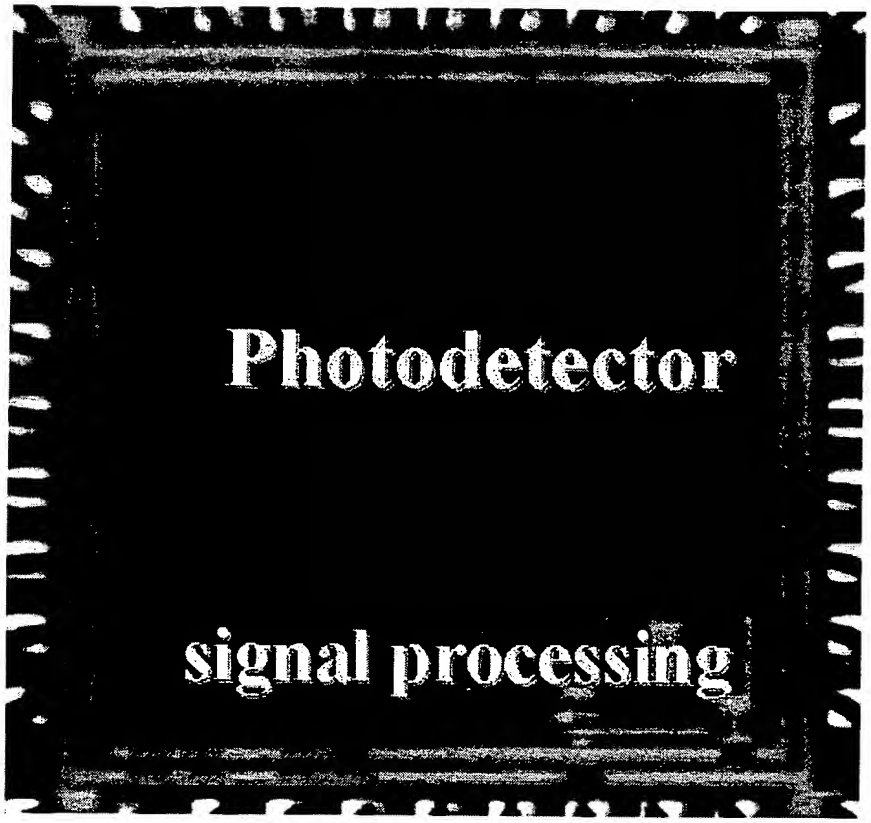


FIG. 45

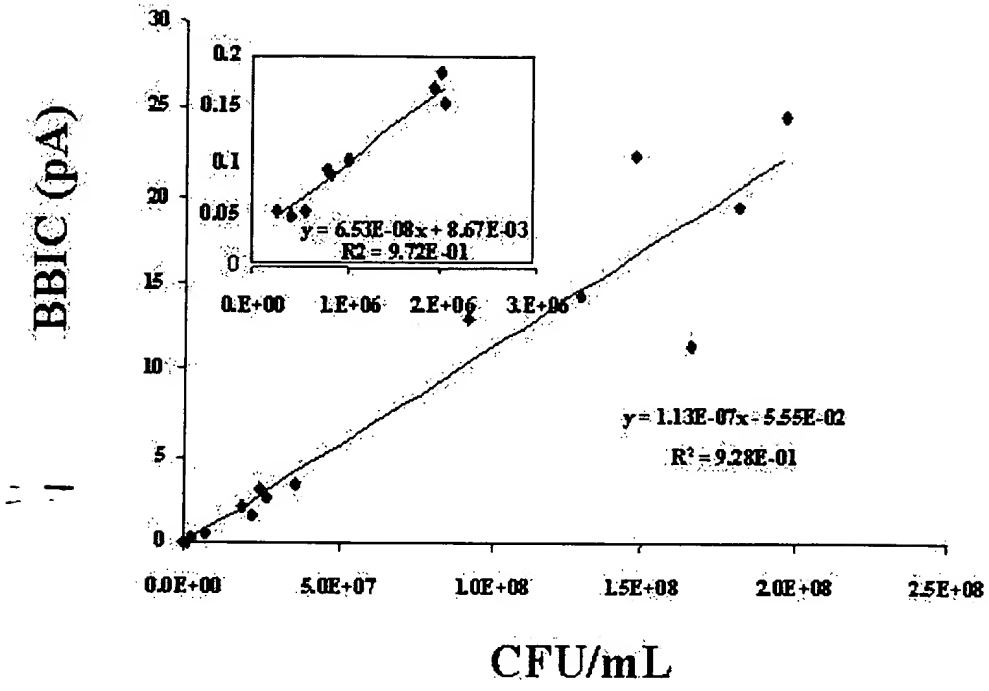

BBIC (pA)
30
25
20
15
10
5
0
0.2
0.15
0.1
0.05
0
y = 6.53E-08x + 8.67E-03
R2 = 9.72E-01
0.E+00
1.E+06
2.E+06
3.E+06
y = 1.13E-07x - 5.55E-02
R² = 9.28E-01
0.0E+00
5.0E+07
1.0E+08
1.5E+08
2.0E+08
2.5E+08
CFU/mL

FIG. 46

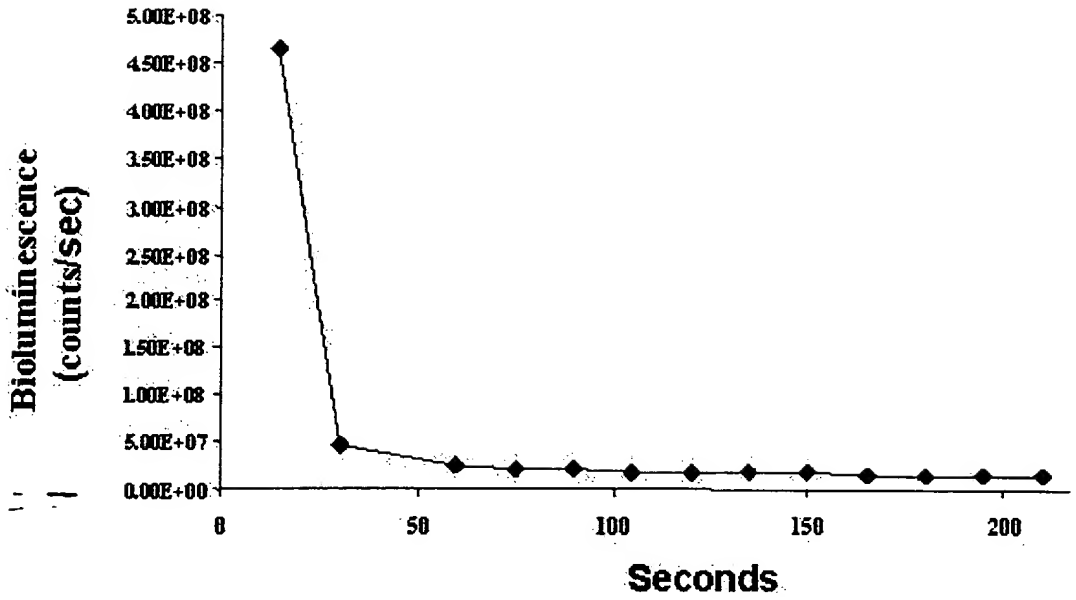


FIG. 47

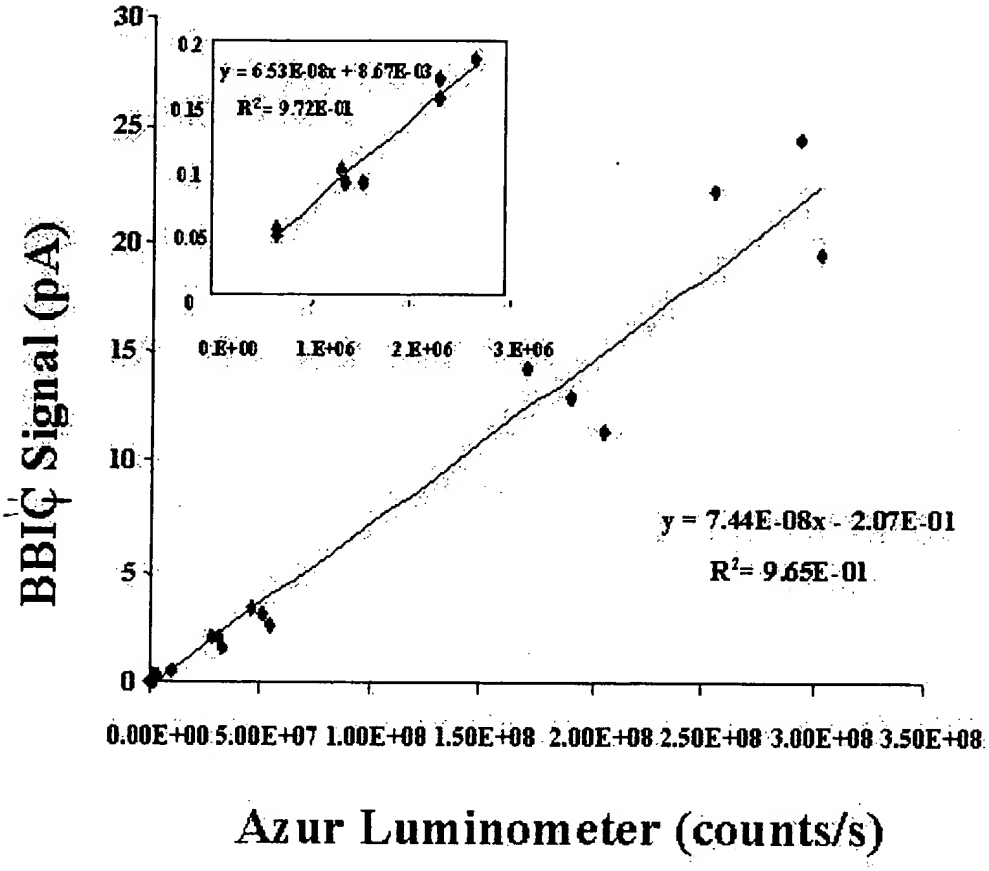

BBIC Signal (pA)
Azur Luminometer (counts/s)
y = 7.44E-08x - 2.07E-01
R²= 9.65E-01
y = 6.53E-08x + 8.67E-03
R²= 9.72E-01
0
5
10
15
20
25
30
0.00E+00
5.00E+07
1.00E+08
1.50E+08
2.00E+08
2.50E+08
3.00E+08
3.50E+08
0.05
0.1
0.15
0.2
0.E+00
1.E+06
2.E+06
3.E+06

FIG. 48

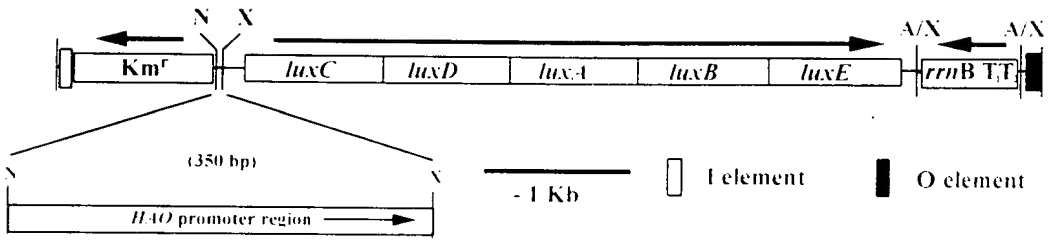


FIG. 49

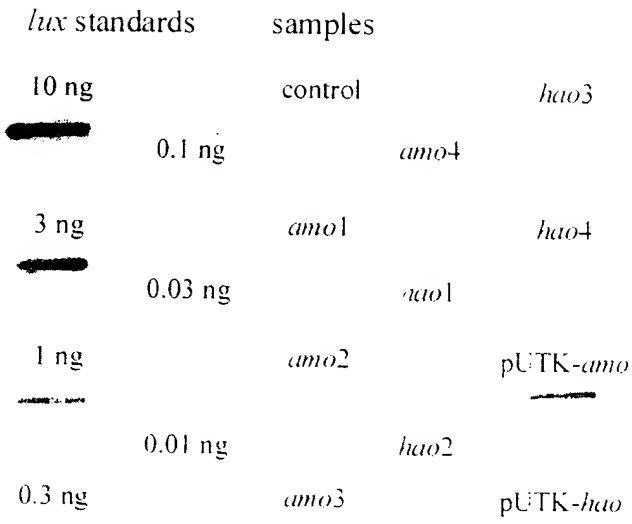

lux standards
samples
10 ng
control
hao3
0.1 ng
amo4
3 ng
amo1
hao4
0.03 ng
hao1
1 ng
amo2
pUTK-amo
0.01 ng
hao2
0.3 ng
amo3
pUTK-hao

FIG. 50

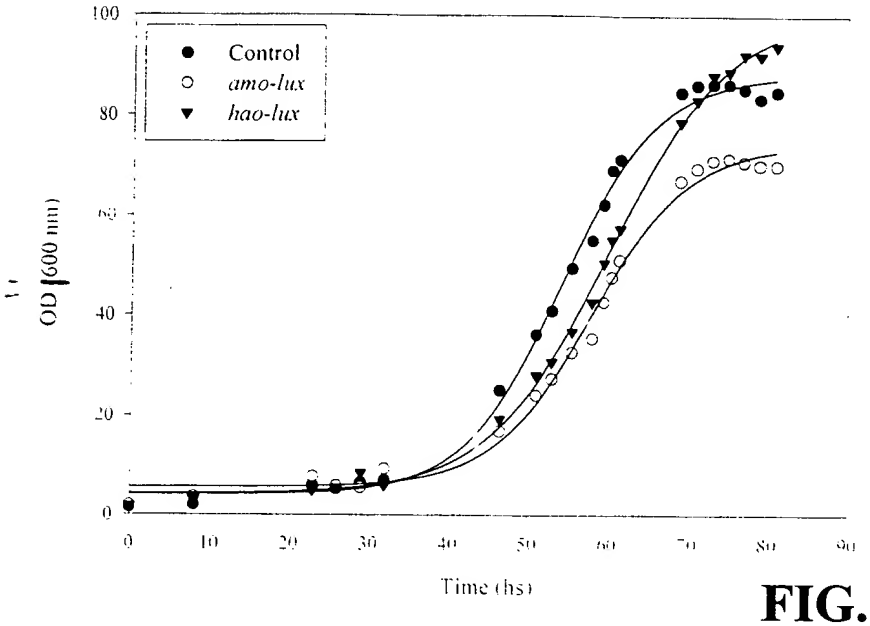


FIG. 51A

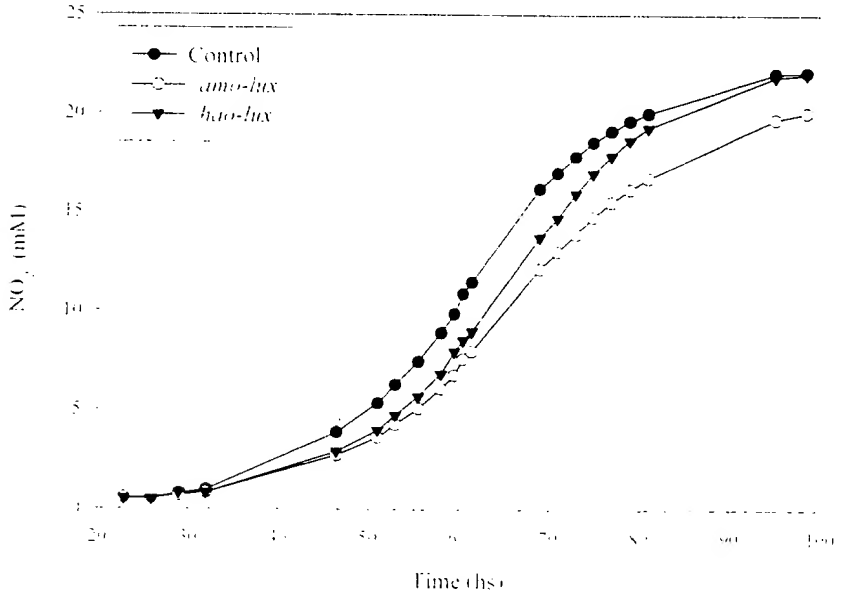


FIG. 51B

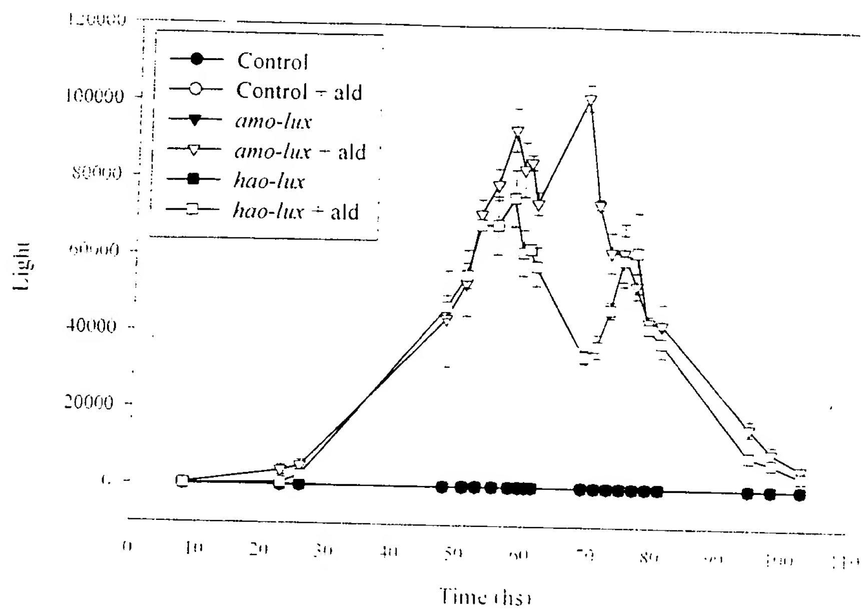


FIG. 52A

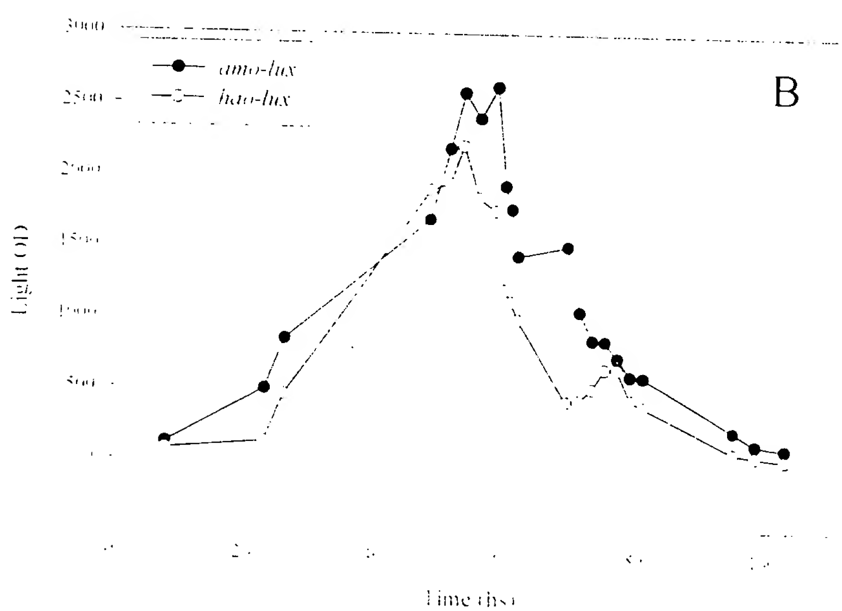


FIG. 52B

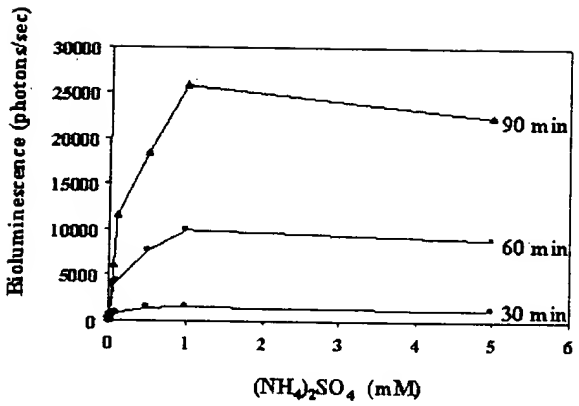

Bioluminescence (photons/sec)
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
90 min
60 min
30 min
(NH4)2SO4 (mM)

FIG. 53

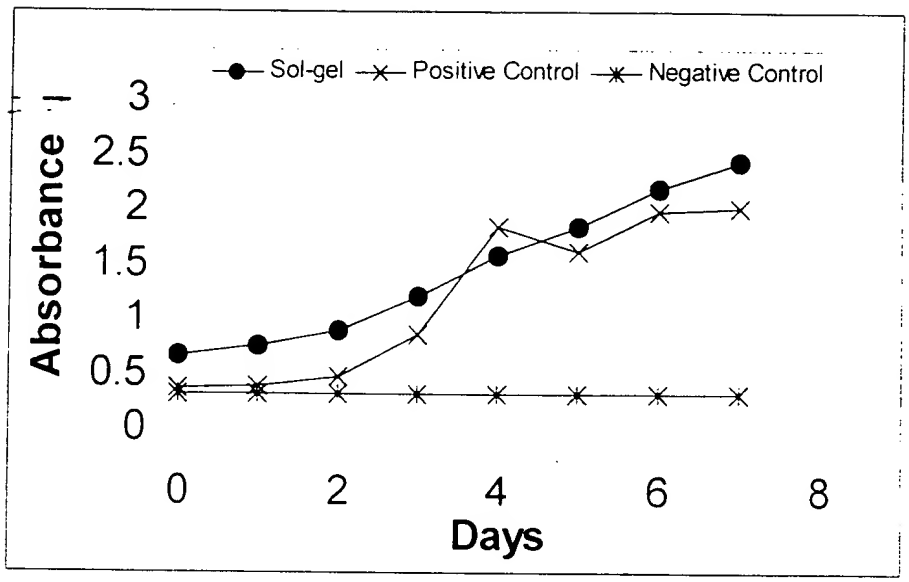

Sol-gel
Positive Control
Negative Control
Absorbance
3
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Days

FIG. 54

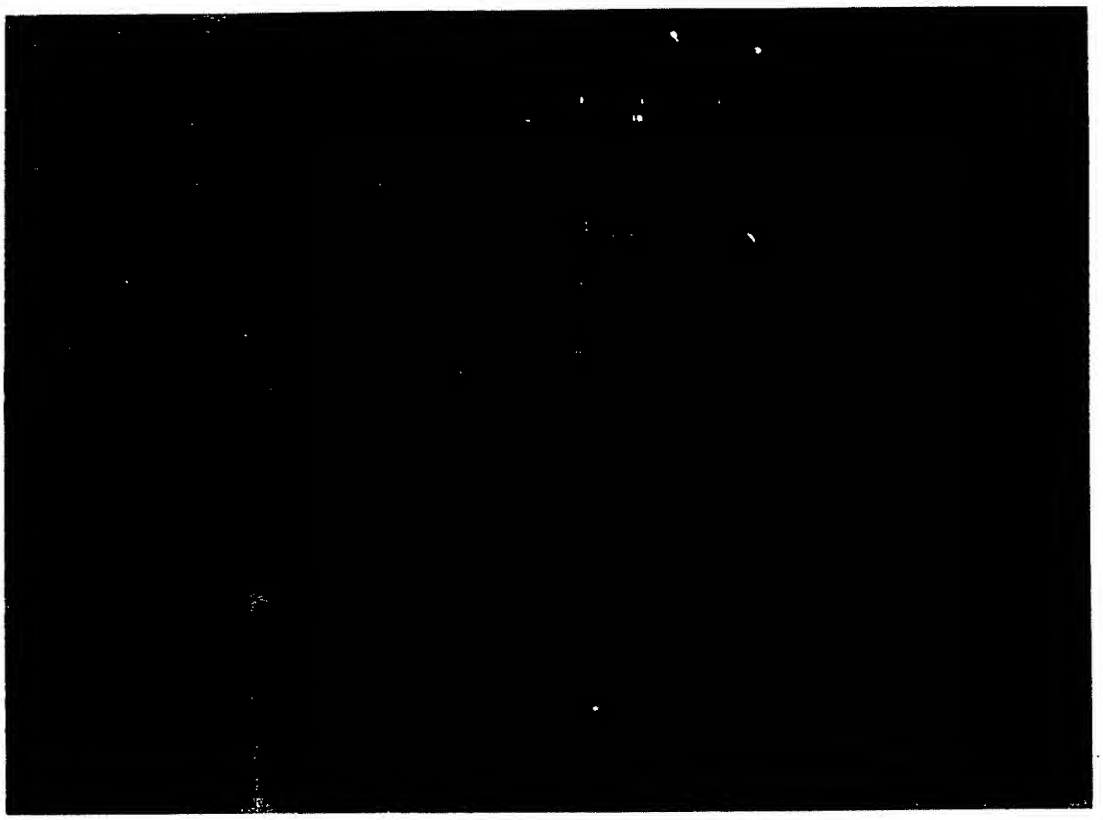


FIG. 55

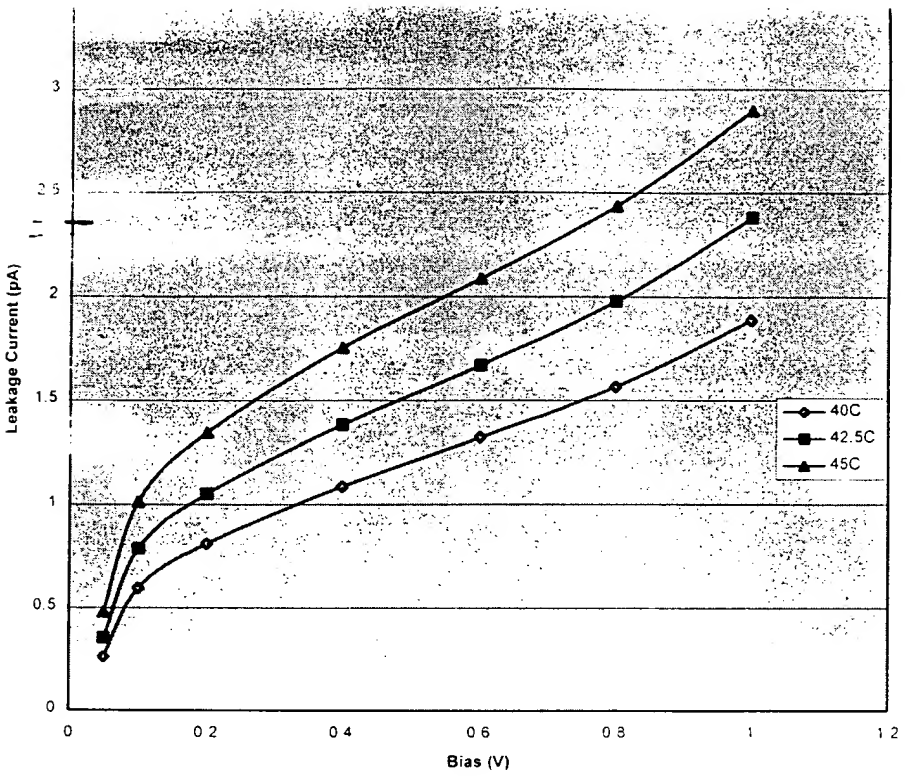

Leakage Current (pA)
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Bias (V)
40C
42.5C
45C

FIG. 56

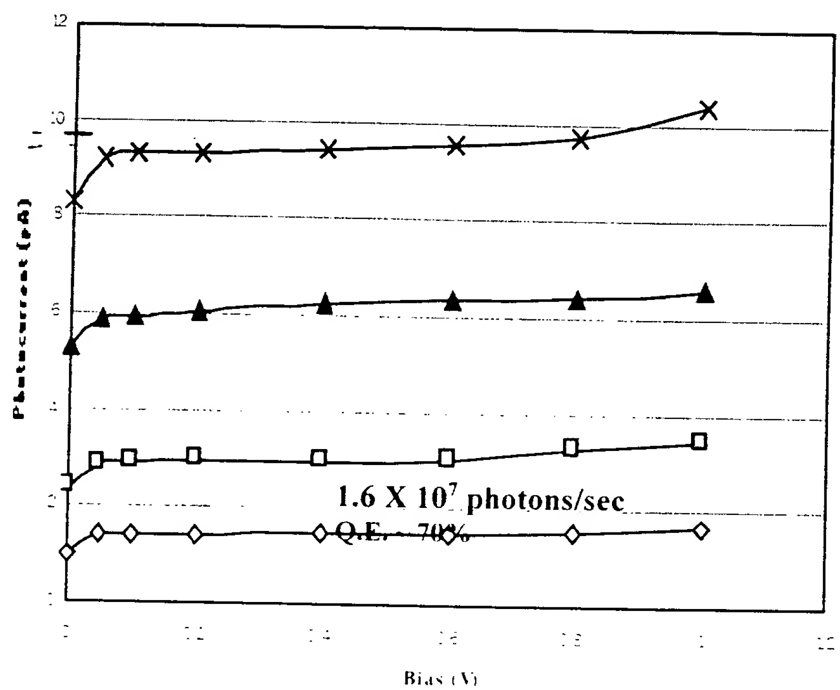


FIG. 57

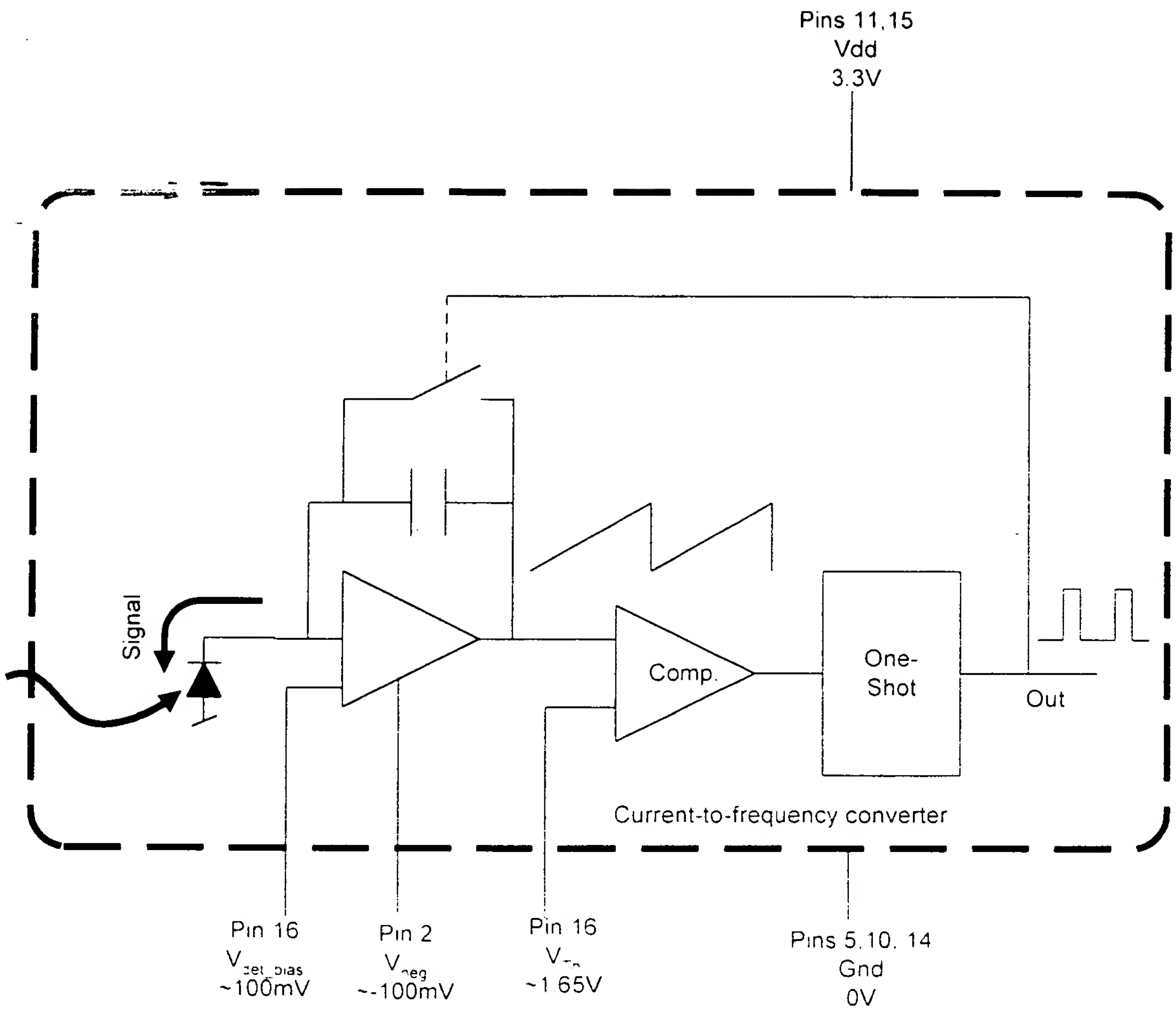


FIG. 58